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Gas Journal

VOL. 300 | 111th YEAR | LONDON, NOVEMBER 25, 1959 | No. 5021 | PRICE 1/6

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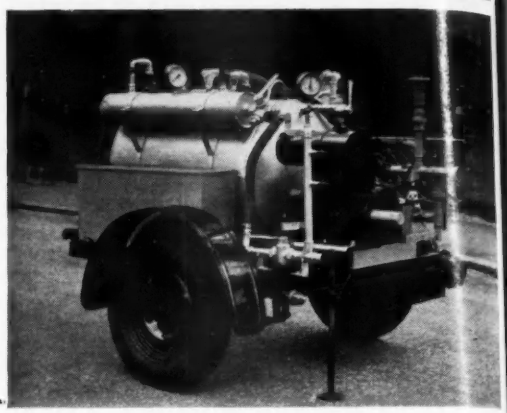
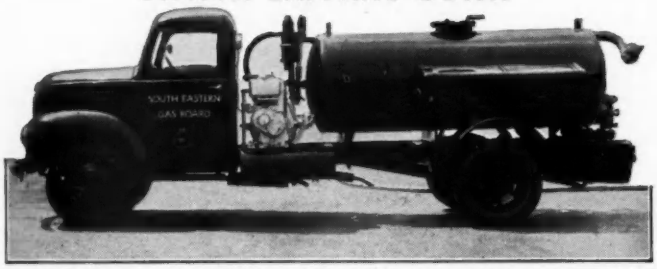


SYPHON EMPTYING OUTFIT



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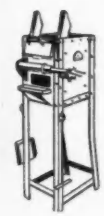

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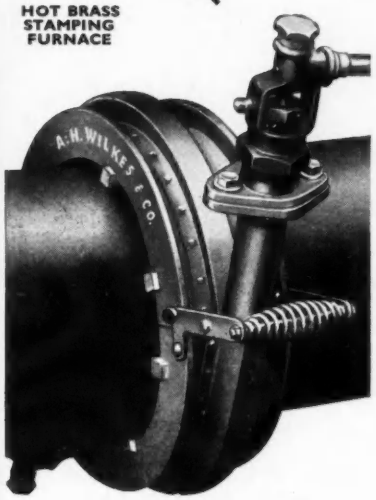

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Gas Journal

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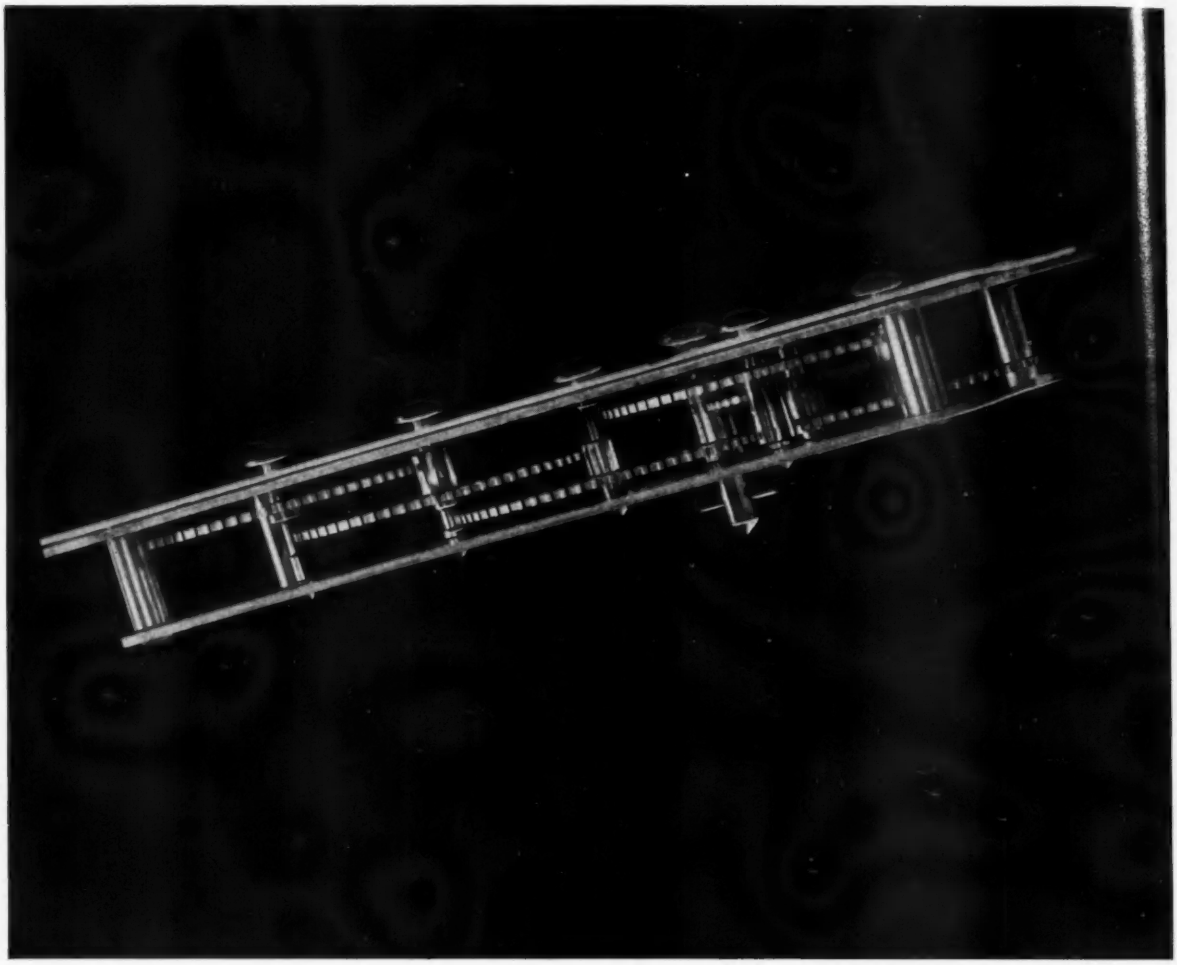

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Gas Journal

VOLUME 300 No. 5021 NOVEMBER 25, 1959 111th YEAR

Gas Research and Investigation

THE highlight of the opening session of the 25th Autumn Research Meeting of the Institution of Gas Engineers held in London last week was the address given by Sir Harold Smith, who at the end of the year will retire from his office as Chairman of the Gas Council. It can be said without hesitation that throughout his long and highly distinguished career in the gas industry Sir Harold has done all within his power to foster research in the industry and he can justifiably look back with pride and gratification on what he has helped to achieve—more especially within the last decade. His guidance has indeed been wise and imaginative.

His address comprised, within small compass, a review of the progress over the past 80 years of the organisation of research in the industry and it should be emphasised strongly that he excluded from his review the research undertaken by individual gas undertakings prior to nationalisation of the industry and by individual gas boards after nationalisation. He also, within his self-imposed terms of reference, excluded the research activities of the manufacturers of gas-making plant and gas-using appliances. Perhaps, therefore, ' Research in the Gas Industry ' was not a very happy title for his objective and strictly factual survey. Certainly the pages covering the years prior to 1952 make sad and sorry reading and to the outsider in no way convey any sense of vitality within the industry's research organisation during that period. Maybe we expected too much from an address of the kind from Sir Harold Smith, something more intimate, more vivid and more entertaining—for even research is not without its sparks of humour. To entertain or to stimulate was obviously not Sir Harold's purpose on this occasion. There is, however, consolation in that the address (which could hardly be described as a ' best seller ') is an accurate and authoritative record and will prove a most valuable source of reference when published in the Transactions of the Institution.

The address is divided broadly into four sections dealing with early investigations, the time when ' organised ' research was in the hands of the Institution, the short and rather unhappy era of the Gas Research Board (1939-1952) and the activities to date of the Gas Council. One page of ' blue-book ' serves to cover early investigations and records the start of research committees which were later to multiply as fishes in the sea. These early investigations were of a strictly practical nature. One of them, undertaken in 1901 by the Southern Association of Gas Engineers and Managers, was concerned with the formation and deposition of naphthalene. Reports on the investigation were received from time to time, but at a meeting of the Association held in 1906 it was announced that the investigation was being brought to an end through lack of funds. The problems—and the naphthalene—were left without solution, greatly to the cost of most gas undertakings in later years.

Rather more than four pages are devoted to the time when research was under the ægis of the Institution—a period covering 35 years. A few interesting and important items from this section of the address may be underlined. Wakening up to the realities of the times, in 1906 the Council of the Institution asked all gas undertakings in the country to contribute to an investigation fund, the basis of the contribution being 6d. for every million cu.ft. of gas made. The response was not brilliant—a matter of £567 from 145 undertakings with promises amounting to a further £50 odd. But it was a start. At once a Special Purposes Committee was appointed and, from that Committee sprung a couple of sub-committees, one to deal with developments in carbonisation, the other to consider the application of gas for heating purposes. The carbonising sub-committee blossomed into a full committee in 1910. In 1914 it was dissolved, its attempts to arouse support and enthusiasm having proved abortive.

The other sub-committee proved to be the beginning of the long association between the Institution and the University of Leeds—an association which has been extremely profitable to the gas industry. At a meeting of the Institution in 1908 it was resolved to perpetuate the memory of Sir George Livesey by endowing a Professorship in Gas Engineering and Fuel at Leeds University, and this Professorship was established in 1910. The research conducted at the University of Leeds on behalf of the Institution and subsequently on behalf of the Gas Research Board and finally the Gas Council, has been supervised by the Livesey Professor.

After less than a page on the activities of the Gas

Research Board, the address turns to the work of the Gas Council. Briefly, when the gas industry was nationalised in 1949 the conduct of research became one of the specific duties placed on the Council and its responsibilities are outlined. Mention is made of the appointment of a Research Committee, the winding-up of the Gas Research Board and the establishment of the Council's two research stations.

In general the Gas Council regards development work beyond the pilot-plant stage as the province of the area boards and of the plant manufacturers. However, the commercial development of the high-pressure gasification processes presents special problems. When these processes have proved successful on a pilot plant at a research station they may require further development on a scale too large for a research station but not large enough to be an economic plant. In these cases it may be necessary for the Council to make arrangements with an area board for a plant to be installed by the board on the Council's behalf at an existing gasworks. One such high-pressure gasification plant is being installed at the Partington works of the North Western Gas Board. Many problems have to be solved when moving to the larger pilot-plant stage and Sir Harold paid tribute to those contracting firms who had expressed their willingness to enter into licence agreements under which the results of research (particularly on gas-making processes involving high pressure) would be exploited commercially. This co-operation, commented Sir Harold in an address singularly free from vigorous personal opinion, ' is an indication of the new gas industry that is evolving and in which research and development must play a leading part.'

Two paragraphs in the address relate to expenditure on ' organised ' research; the first is certainly depressing. Thus in 1918 the Institution was able to spend £1,350 on actual research; in 1939 (the year the Gas Research Board was formed) the sum of £8,500. In 1948 the Institution, *on behalf of the industry* (our italics), subscribed £32,000 to the Gas Research Board, whose total annual expenditure had amounted to only £80,000.

By comparison the second paragraph is much brighter. It gives an estimated figure of expenditure on research by the Gas Council for the year ending March 31 next of £800,000. But by today's standards and bearing in mind the annual revenue of the gas industry and the competition which it has to face this is not a large sum to allocate to the purpose. We have gone a long way during the period covered by the review but much remains to be done to stimulate interest in research throughout the industry. At the same time Sir Harold is doubtless right in his careful and qualified statement that ' we can face the future with confidence in the knowledge that we now have a research organisation designed to cope with the problems that will arise.' There is, of course, significance in the word ' designed.'

Underground Storage of Gas

UNDERGROUND storage of natural gas has been an established practice in the United States of America for many years; indeed, some 200 underground storage projects are in operation, in the development stage or planned in the U.S.A. There are other examples of underground storage in Europe, notably the Beynes reservoir on the outskirts of Paris which currently stores about 6,000 mill. cu.ft. of coke oven gas and serves the Greater Paris area. In Britain the first underground gas storage project to be brought into operation is situated on the north bank of the River Tees, and the story of its development was unfolded with characteristic modesty by Mr. E. Crowther, Chairman of the Northern Gas Board, in a highly important and wholly fascinating communication at the Research Meeting of the Institution. Presentation of the paper was followed by a discussion far removed from the ordinary. An abstract of the paper and a full report of the discussion, which was marked by style, frankness, substance and enthusiasm, will be found on later pages.

As far as is known the project in the North of England is the first example of the use of a cavity in a natural seam of rock salt for the storage of gas under pressure. The installation is not vast; the storage capacity at the normal maximum working pressure of 30 atm. is equivalent to that of a 10 mill. cu.ft. low-pressure holder. The significance and the potentialities of the scheme are, however, very vast indeed and the economics are immensely attractive. Thus combined operating and capital costs, which represent a shade over 2d. per therm of gas injected into the cavity, are about one-half the capital costs alone of a conventional holder of similar capacity. The economics of the project as a whole are closely reasoned in relation to an integrated area where a well diversified demand of 35,000 mill. cu.ft. a year is served; and a net saving exceeding £10,000 a year is anticipated from the project. Apart from the financial benefit, the ability to increase storage capacity while occupying a mere fraction of the three acres or more of land that corresponding low-pressure storage would require is clearly advantageous. And, as Mr. Crowther put it so neatly, there is ' avoidance of æsthetic offence to any who fail to see beauty in the structural simplicity of conventional holders.' On this point the comments of Mr. C. H. Leach during the discussions were couched in somewhat stronger terms.

Undoubtedly the project is a pointer to future developments. This was stressed by several speakers during the animated and invigorating discussion, and in this regard we call attention particularly to the contributions of Dr. J. Burns and Mr. A. G. Grant, which clearly demand study. There is, for example, the possibility of methane storage. The underground cavity now in operation could contain 200 tons of gaseous methane at 30 atm. pressure. Again, if it were turned over to store butane and propane as liquids, it could contain something like 5,000 tons. Following the experience gained it is by no means idle to speculate on a project of major scale. Such a project might involve the use of a group of 30 of the existing abandoned cavities in the rock salt seam being worked by Imperial Chemical Industries Ltd. At 45 atm. they would enable

1,350 mill. cu.ft. to be stored and gas production to proceed, except as interrupted by plant repairs, substantially at a uniform rate throughout the year. Mr. Crowther put the cost of such a project, which would present no difficult engineering problems, at £1 mill. or more, but it would enable production plant of about 40 mill. cu.ft. to be dispensed with, plant of which the replacement cost would be between £4 and £10 mill. depending on its nature.

Apart from this refreshing long-term prospect, the present installation is capable of affording information of the greatest value in planning high-pressure distribution systems, in developing anticlines for gas storage and in studying the storage of other fuels at various temperatures and pressures. In this regard Mr. Crowther's suggestion that it might be possible at certain periods of the year to place the installation at the disposal of the Gas Council's research groups as a full-scale laboratory for such studies will give rise to satisfaction, gratification and, we hope, action.

Personal notes

MR. C. BROOKS was elected President of the Cumberland and Westmorland Gas Managers Association at the autumn meeting in Carlisle recently. Other appointments were: Vice-President: MR. G. H. CRAIG; Honorary Secretary: MR. E. JACKSON.

MR. MICHAEL G. COHEN is taking up residence immediately in the United States as a Vice-President of George Cohen 600 Incorporated, of 30, Church Street, New York—the American company of George Cohen, Sons & Co. Ltd.

MR. D. K. FRASER, at present Managing Director of Petters Ltd. of Staines, will be joining the Board of G. A. Harvey & Co. (London) Ltd., in the near future.

MR. F. BONSALL, who has been Director and General Manager for the past four years, has been appointed Deputy Managing Director of British Furnaces Ltd., Chesterfield.

MRS. G. EVERSHED, Chairman of the Women's Gas Federation, has been appointed a member of the North Thames Gas Consultative Council.

MR. A. H. THOMAS has been elected President of the Purchasing Officers' Association for 1959-60.

PARKINSON COWAN INSTRUMENTS

PARKINSON Cowan Gas Meters will be undertaking responsibility for the sale to the gas industry of the telemetering and control equipment manufactured by their associated division, Parkinson Cowan Instruments. From December 1 MR. C. VARCOE will be regional Sales Manager in the Northern, North Eastern and North Western Gas Board areas. MR. T. H. JOHNSON will continue to be responsible for the Scottish Gas Board area and MR. S. ARMITAGE for the Wales, West Midlands and South Western Gas Board areas.

Diary

November 27.—INSTITUTION OF PLANT ENGINEERS, BIRMINGHAM BRANCH: Imperial Hotel, Temple Street, Birmingham. 'Instrumentation in Industry with particular reference to control of temperature, pressure flow, weight, etc.' by L. F. Cohen, Elliot Bros. (London) Ltd. 7.30 p.m.

November 27.—JUNIOR INSTITUTION OF ENGINEERS: Pepys House, 14 Rochester Row, Westminster, S.W.1. Annual General Meeting. 7 p.m.

November 27.—NORTHERN JUNIORS: Gas Showrooms, Darlington. 'Management Graphies' by H. Buckley. 2.30 p.m.

December 1.—SOUTH EASTERN G.C.C.: Caxton Hall, Westminster, S.W.1. Council Meeting at 11 a.m., followed by Combined Meeting of the Consultative Council District Committees at 2.30 p.m.

December 1.—INSTITUTE OF FUEL, NORTH EASTERN SECTION: Chemistry Lecture Theatre, King's College, Newcastle-on-Tyne. 'Gas Chromatography' by H. N. Wilson. 5 p.m.

December 2.—MANCHESTER JUNIORS. Gooldass Wall & Co. Ltd., Speke, Liverpool. Short Papers for F. Johnston Prize.

December 2.—EASTERN JUNIORS: Luton. Short Paper Competition.

Obituary

MR. C. HALES-FINCH, sales representative of Radiation Group Sales Ltd., for the Southern Gas Board area, has died, aged 61. He was with John Wright & Co. Ltd. for 25 years before the formation of Radiation Group Sales Ltd. in 1950.

MR. FREDERICK W. SIMPSON, a former manager of Chilton (Durham) cokeworks, has died at Spennymoor, Co. Durham. Latterly he had been in business as a contractor for road materials.

MR. WILFRED QUILLER has died at the age of 55. Mr. Quiller was chief chemist at the South Western Gas Board, Coxside, Plymouth.

MR. WILLIAM P. TUCKER, formerly manager of the Wokingham Corporation gasworks, has died, aged 81.

Sir Frederick J. West: An appreciation

Mr. D. D. Melvin, President of the I.G.E., writes: In the death of Sir Frederick West the gas industry and the Institution of Gas Engineers has lost a valued friend and adviser. Others may speak of his work for Manchester and the North West, culminating in his mayoralty of that city and of the recognition of his work for the community in many honours lists and in other ways. I should like to pay tribute to his work for the industry and in particular, to his lifelong active interests in the affairs of the Institution of Gas Engineers and its members. These services were recognised in 1925 when Sir Frederick was elected an honorary member although, after the granting of the Royal Charter, he became a member in his own right. Election to our Council followed in 1935 and in 1941-42 he served the Institution as president, thus following the example set by his eminent father, John West, who was president, in 1894, of the Incorporated Gas Institute. So highly regarded were his services for the advancement of the knowledge of gas that he was awarded the Birmingham Medal in 1947, almost 30 years after his father received the same award—a unique record in our annals. Sir Frederick brought his great experience and knowledge to bear in the formulation and operation of the Institution education scheme and made many valuable suggestions regarding recruitment and training. His William Young Memorial Lecture in 1938 on 'The Education, Training and Selection of the Technical and Administrative Personnel of the Gas Industry' will long be remembered as recording his thought on these important matters which are as cogent to-day as they were then. His work, too, for the status of gas engineers and the advice and help he gave on many occasions were of great help and value to all concerned with these issues. Despite the eminent positions he occupied, his characteristic approachability remained both to his fellow gas engineers, irrespective of position and, as was evidenced when touring his much-loved works, to every employee there. His hope, expressed in 1925, that it would be as Fred West that he would retain the regard and good-fellowship of the members of the Institution and to continue to be of some service to the gas industry was amply fulfilled.

Warm weather takes toll of gas consumption

HEAVY APPLIANCE BUYING DURING SPRING QUARTER

SALES of gas appliances continued to increase during the April-June quarter of 1959. Cooker sales were higher by 55,000 (an increase of 45%); space heater sales by 49% and water heaters by 42%. Refrigerator sales rose from 17,000 to 26,000.

The quarter was warmer than in the previous year—and gas sales were 3% lower. Compared with April-June, 1958, total gas made was nearly 7% lower. But increased purchases of gas from coke ovens and oil refineries meant that the quantity of gas available was only 4% lower than in the previous year.

Domestic sales were down by more than 2½% and industrial sales fell by 1% with some indication of a recovery of sales with higher industrial production. Commercial and other sales, however, were the most severely cut, being 8% lower than in the April to June quarter, 1958. Total sales of gas for the first quarter of 1959-60 were 3% lower than a year ago.

Unchanged

The average revenue per therm of gas sold has remained unchanged at 21d. per therm.

Coke production was more than 10% below the level of April to June 1958 and sales for the same period fell by 26%. Crude tar production and crude benzole made were both 6½% lower than a year ago.

New gas-making capacity of 18.6 mill. cu. ft. per day, was brought into use during the April to June quarter 1959. No new carbonising plant was brought into use during the quarter.

The length of new mains laid during the quarter, 527 miles, showed an increase of 16% over the corresponding period of last year.

Between the end of July, 1958 and the end of July, 1959, the number of persons employed in the gas industry fell by 3½% to a total of 128,800.

Sc.G.B. Driver of the Year tests

THE first Driver of the Year competition to be held by a nationalised industry in Scotland has just been held by the Glasgow and Western Division Scottish Gas Board. It attracted more than 300 entries, from a baby saloon car to a mobile showroom. Sixteen drivers and their vehicles took part in the finals, which consisted of a route test, four manœuvring tests and questions on the Highway Code.

The premier award—a silver cup presented by the Ford Motor Co. Ltd.—went to a Glasgow driver, Mr. W. Connell.

Congratulating the successful drivers, Mr. J. B. McLaren, the presiding judge, said the standard of driving had been high. Competitions such as these could play an important part in promoting road safety.

This picture was taken at the Careers Exhibition recently held in Cardiff. The Lord Mayor of Cardiff is seen here (left) talking to an apprentice, with Mr. T. Mervyn Jones, Chairman of the Wales Gas Board, and Mr. J. Powdrill, General Manager and Engineer of the Cardiff undertaking.

£357,000 blast furnace order to Head Wrightson

HEAD WRIGHTSON Iron & Steel Works Engineering Ltd., a subsidiary of Head Wrightson & Co. Ltd., has received an order from Colvilles Ltd. for the supply and construction of a blast furnace gas cleaning plant at Ravenscraig, in Scotland. The plant will mostly be manufactured by the Head Wrightson company at its works on Teesside. Value of the contract is £357,000.

Strip mill project

This is an extension to a similar plant constructed by the company two years ago at Ravenscraig and forms part of the extensive strip mill project which Colvilles, Ltd., are at present undertaking. The complete plant will be capable of cleaning 15 mill. cu.ft. per hour of blast furnace gas and new equipment now to be supplied will comprise one gas washing tower and two Head Wrightson Research Cottrell wet tube electrostatic precipitators, together with the necessary gas mains, valves, pumps and water mains. Ancillary equipment will also be supplied for the handling and recovery of sludge from the circulating water system.

It is expected that the plant will be in commission by the middle of 1961. On completion, this plant will be the 12th of its type to be supplied by the Head Wrightson firm to the iron and steel industry during the last eight years.

BIRMINGHAM FIRM'S CANADIAN ORDER

TANGYES LTD., the Smethwick (Birmingham) engineering firm, has been awarded a contract for the supply of hydraulic equipment to Canada Iron Foundries Ltd., which is to manufacture the tunnelling shields to excavate the Bloor University Avenue subway in Toronto. The equipment consists of cylinders and rams, erector arms, and hydraulic pumps.

This order, valued at $600,000, has been secured against keen international competition on both price and delivery, after intensive activity by the Tangye selling organisation in the dominion, Tangyes of Canada Ltd., in Montreal.

Better known

The method of cutting tunnels with a cutting shield forced through the earth by hydraulic cylinders and rams, has become better known of late through a number of projects for which Tangyes Ltd. has supplied the hydraulic equipment. They include the Metropolitan Water Board tunnel, British Railways tunnel at Potters Bar, the Dartford tunnel and similar equipment is now being supplied for the Clyde tunnel. The two latter projects are believed to be using the largest shields ever manufactured.

Operation Lurgi crosses the River Forth

Longest gas pipe underwater in Great Britain

THE 2,000 ft. crossing of the River Forth with a steel pipe-line—part of the Scottish Gas Board's plan to carry gas to a large area of Central Scotland—was successfully completed last week. This was the longest river crossing to be undertaken by the British gas industry.

At the tiny village of Dunmore, about 2½ miles upstream from the Kincardine Bridge, on the south bank of the river, a 50-ton winch was switched on and the specially-prepared piping, gripped by a cable, slid into the waters of the Forth and was pulled over to the north side. For the operation, the Board engaged the services of Land & Marine Contractors Ltd.

Cathodic protection

The pipe-line, which has a diameter of 12 in., is of seamless steel, giving a good degree of flexibility, and was made in Scotland by Stewarts & Lloyds, Ltd., to an American specification. It is being given cathodic protection and in addition the pipe is specially treated with a bitumen-asbestos sheathing reinforced with fibre glass.

It crosses the river in two 1,000-ft. twin lengths.

Originally the engineers planned, in order to negotiate the Forth, to cut the twin channels across the bed of the Forth by means of powerful hydraulic jets. Ultimately, however, they decided to use a more conventional method of dredging.

A comprehensive and accurate underwater survey of the river bed had to be carried out. That was done by probing the depths of the river bed at regular intervals.

Mr. R. O. Emmony, Distribution Engineer of the Scottish Gas Board, said the actual operation of laying the piping under the Forth would cost about £60,000.

76-mile stretch

The scheme is all part of Operation Lurgi. About 30 mill. cu. ft. of gas will be produced daily from Britain's first Lurgi high-pressure plant, which is now in process of building at Westfield, Fife, and will be distributed over a wide area. The pipe-line laid last week to cross the Forth is part of a 76-mile stretch from Dunfermline to Coatbridge, which is due to be completed next Autumn.

The total length of the completed grid, as at present contemplated, will be about 260 miles of steel pipe-line capable of working at pressures up to 250 lb. per sq. inch. Built-up areas are being avoided by the main pipe-lines and on the outskirts of densely populated areas special pressure-reducing equipment will be brought into operation.

Sales and service officers of the North Western Gas Board recently visited the works of Parkinson Cowan Appliances Ltd. Pictured here are (back row) Mr. K. Leech, Area Manager, P.C.A. Ltd.; Mr. W. Mottram, Mr. H. H. Thomas, Mr. J. F. Funk, Mr. F. Craven, Mr. J. Denham, Mr. F. Fisher, Mr. A. Entwistle, Mr. E. Newbigging, Sales Promotion Manager, P.C.A. Ltd.; Mr. H. Hough and Mr. A. Harrison. (Front row): Miss D. Edwards, Home Service Adviser, P.C.A. Ltd.; Miss H. Swindells, Mr. H. Butters, Mr. J. L. Anstey, Sales Director, P.C.A. Ltd.; Mr. J. W. Rodgers, Mr. S. Hopkinson and Mr. K. F. Hollingsworth, Sales Manager, P.C.A. Ltd.

'25-YEAR-CLUB' HEARS BRYAN DONKIN CHIEF TALK OF FIERCE COMPETITION

REFERENCE to the fierce competition prevailing in the gas industry today, and the need for greater co-operation between employee and employer, was made by Mr. Alexander Abel Smith, Chairman of the Bryan Donkin Co. Ltd., at the company's seventh annual '25-year Club' dinner, held in Birmingham recently.

Hard struggle

Speaking during the dinner, Mr. Smith said that the gas industry was up against a great deal of competition from other forms of power and that it was having a hard struggle to hold its own. He spoke of the difficulties of keeping prices down and suggested that one way in which this could be achieved was by seeking improved products and better designs. 'All of us have got to study new methods which will enable us to be more efficient and to produce better equipment at a lower cost,' he said. He went on to describe the changes that were being made in the company and the improved machinery which was being installed. He stressed the need for research and development and asked for the co-operation of all employees in helping to maintain the high standard of efficiency for which the firm was noted.

Total membership

This year, 20 employees qualified for membership of the Club, bringing the total membership (including retired members) to 219. During the past year 18 members retired and two retired members died. Seven members of the Club have completed 50 years' service and over, 41 members have 40 years' service and over, 80 members 30 years' service and over and 43 members 25 years and over.

Among the other directors present were Mr. F. Brian Holmes, Vice-Admiral Sir Conolly Abel Smith, Mr. G. F. Chambers, Mr. J. Connerton and Mr. C. W. Ashton.

During the proceedings it was announced that Mr. F. D. Bradshaw, who was admitted to membership of the Club last year, had been appointed Managing Director of Bryan Donkin, Canada, Ltd.

YORKSHIRE JUNIORS AWARDS

THE Clayton gold medal was awarded to Mr. T. A. Marriott for his paper 'The Gas Industry and Agriculture,' at the annual meeting of the Yorkshire Junior Gas Association in Doncaster recently. Mr. R. S. JOHNSON, M.B.E., Chairman of the East Midlands Gas Board, was present to see Mr. E. C. Williams selected President in succession to Mr. R. E. White.

The Clapham silver medal was awarded to Mr. R. Fleming and Mr. P. G. Harris for their joint paper. 'Desulphurisation by Oil-Washing.' The authors also received the S.B.G.I. silver medal awards.

SILVER JUBILEE | RESEARCH MEETING OF THE INSTITUTION

Research: KEYSTONE OF PROGRESS IN THE GAS INDUSTRY

Today, more than at any previous time, research is accepted as the keystone of the gas industry's future prosperity. An unusually wide range of research projects were described at the I.G.E. Autumn Research Meeting last week, the highlights being Sir Harold Smith's address and Mr. E. Crowther's paper on underground storage.

THE 25th Autumn Research Meeting of the Institution of Gas Engineers was held at Church House, Westminster, on November 17 and 18, under the Presidency of Mr. D. D. Melvin.

This year there were rather fewer visitors from overseas. Those welcomed by the President included M. R. H. Touwaide, of Brussels, the General Secretary of the International Gas Union and Belgian Gas Association; M. R. L. Nancy, of Toulouse, Office National Industriel de l'Azote; and M. A. Renauldon, of Paris, Gaz de France; Dipl.-Ing. W. Hermann, of Hamburg Gasworks; and Dott.-Ing. A. Guella, of Milan, Societa Edison. And it was announced that Mr. W. Wood Prince, President of the Armour Company, Chicago, and Mr. E. Battson, President of Constock Limited, New York, would join the meeting later.

Honorary members

The Secretary, Dr. W. T. K. Braunholtz, reported election of Dr. Harold Hollings, O.B.E., and Dr. Arthur Key as Honorary Members. Of them the President remarked that Dr. Hollings had advised and assisted them on many chemical problems and in their research work, and Dr. Key had assisted them in many ways, and his name would be long associated with his well-known and well-read publication.

There followed the Presentation of Awards for 1959, when the President presented the Diploma in Gas Engineering (Manufacture) to Cyril Halstead (Birmingham) and James Hatfield (Derby). The Charles Hunt Memorial Medal, awarded to Donald Read (Singapore), Associate Membership Examination—Gas Engineering (Supply), would, it was announced, be forwarded to him. Donald Ernest Jarvis (London) and Ronald Windle (Sowerby Bridge) were awarded the James Archibald Maclay Memorial Prizes in Gas Technology (Supply) and Gas Salesmanship and Consumer Service respectively.

Sir Harold's address

After the presentation and discussion of the 20th Report of the Chairman's Technical Committee, delegates heard an address by Sir Harold Smith, K.B.E., D.L., LL.D., on 'Research in the Gas Industry,' at the conclusion of which the author permitted himself a few observation's on the industry's future.

'We all know' he said, 'that for 150 years we have depended on good quality gas-making coal for making gas. For a variety of reasons we have not been able to get all the good quality gas-making coal, at any rate at the price we wanted, to make all the gas we wanted. In addition to difficulties with coal, we have had our difficulties with coke. It is not quite so easy in Great Britain or on the Continent of Europe or in Scandinavia to sell all the coke you make. For a variety of reasons we have been driven to look for other raw materials and for other methods of gas production.

'Behind all this today is the very sure conviction that the price of gas is too high. We know that gas is a fuel which will compete with and, from the point of view of efficiency and service to the consumer, will beat any other fuel which is available to him. The one thing which is preventing it from going ahead as it should is the price. We are now too dependent on the weather. A month or two of warm weather completely upsets our balance sheet. We must not let ourselves remain in that position.

First-class appliances

'The appliance makers have produced for us first-class appliances which are rapidly increasing in efficiency. Most area boards have adopted tariffs which make the use of these appliances just possible. We have got to bring the price of gas down so that the use is not just possible but that everybody insists on using gas appliances.'

Sir Harold went on to refer to the various new processes. 'You must look at these new processes in conjunction with the national grid.' he explained. 'Remember that our plan, the target at which we are aiming, is a comparatively few large stations, large high-pressure complete gasification or hydrogenation stations, capable of gasifying or hydrogenating oil or coal. We know that for very many years we shall depend on coal as our principal raw material, but we are determined that we shall be able to choose the type of coal we want for gas making. The type which we hope we shall want will be a much cheaper and smaller, non-caking coal than we have been using. We must visualise gas from these large stations going into a national grid. Think what that will do. No transport of raw materials. Possibly eventually—not in the lifetime of many of us but eventually—no coke; only gas and liquid products to be dealt with. No road transport for carrying coal, oil or coke.

Underground storage

'Coupled with that we are searching for suitable sites for underground storage. If you imagine gas being made on the coalfield or at the oil refineries, at a pressure of 400 lb. per sq. in., with practically no sulphur and practically no carbon monoxide, being delivered into a national grid and that connected to an underground storage provision of this kind, the national grid also taking surplus gas from coke ovens, which is still reasonably priced gas, as well as methane from coal mines, tail gases from the oil refineries, and last but by no means least, gas from liquid methane, you will begin to get a picture of a new gas industry growing up in the next ten or 15 years quite differently from the past.

'I should like you to consider the curve in the progress in research from 1880 up to today and to apply this curve to the progress in the gas industry in the future. If you all keep your eye on the ball and hit it straight down the middle, and do not permit yourselves to be deflected from your target by anybody—and I repeat, anybody—you will win this golf match in the future.'

Methane Pioneer

Referring to the voyages of the Methane Pioneer, Sir Harold said: 'I think that even the most cautious of us can say that the technical problems can be considered to be solved. Now

the only problems to be solved are the economic problems, and those do not look as though they will be so frightfully difficult to solve.'

He turned next to the pilot hydrogenation plant at Partington. 'As we expected, we have found engineering difficulties in connection with this sort of operation, but I believe that we are getting over those. Dr. Dent is working on a pilot hydrogenation plant at Solihull and, after the initial difficulties which were put right, he has had several successful runs. This is a 1 mill. cu.ft. per day plant. The question which you may all be asked by people who are interested is: "Why do you want to bother with a complete gasification plant or hydrogenation plant when you have a Lurgi plant?" . . . The Lurgi plant is a little bit choosey on coal. It makes a low-grade, low quality calorific value gas which must be enriched. It presents enormous effluent problems. We are hoping that the plant which we are trying to develop will be a plant on which the effluent problems will be reduced to a minimum. The gas made will be of high calorific value, about 600, 700 or 800 B.t.u. per cu.ft. The carbon monoxide content will be practically nothing, the sulphur content will be practically nothing and the pressure will be 400 lb. per sq. in.

'But you must look on those plants in conjunction with a national grid. The whole lot hang together. Where the suitable coal is available for Lurgi plants and where we can find a reasonably priced method of enrichment, I hope that we shall see more Lurgi plants going in. I hope that nothing will be done which interferes in any way with the progress of what I am sure those of us who are closely associated with it feel, will be a very much superior plant—the hydrogenation plant.'

A vote of thanks to Sir Harold Smith was proposed by the Senior Vice-President, Mr. H. S. Cheetham, and seconded by Junior Vice-President, Mr. T. C. Battersby.

The President then presented to Sir Harold an album containing the signatures of past-presidents, honorary members, members of Council and others closely associated with the works of the Institution.

Presentation

After the Autumn Research Luncheon at the Savoy Hotel members reassembled for two concurrent sessions, held in the Assembly Hall and Hoare Memorial Hall respectively. Those gathered in the former heard papers on "An Investigation of the Effect on Effluent Disposal of the Electro-detarring of Hot Gas' by W. H. Blackburn, M. Kershaw and J. R. Catchpole; 'The Vacuum Carbonate and Contact Acid Plants at Beckton' by J. S. Cooper and R. M. Johnson; and 'The Operation and Testing of Connersville Meters' by G. Dougill. The latter group heard 'The Design and Performance of Natural Flue Terminations and Mechanically Assisted Systems' by Dr. R. Wills, E. W. G. Dance and G. T. Blench; 'A Recuperative Town Gas-fired Furnace for Temperatures up to 2,000°C.' by E. A. K. Patrick and R. D. Hastie; and 'Flame Traps for Use with Town Gas/Air Mixtures' by P. A. Cubbage.

The following day the meeting, held in the Assembly Hall, commenced with the presentation and discussion of the 50th Report of the Joint Refractories Research Committee and the presentation of two papers:—'Pressure Storage of Town Gas in a Prepared Underground Cavity' by E. Crowther, and 'Some Recent Investigations Relevant to the Use of Town Gas in Industry' by D. W. Gill and G. G. Thurlow. The afternoon session included the presentation of the Report of the Gas Council Research Scholarships, and the presentation and discussion of the Institution Gas Research Fellowship Report 'The Measurement of Ignition Temperatures in Gases' by B. G. S. Taylor and J. E. Garside, the 2nd Dempster Travelling Fellowship Report 'Continental Uses of Gas in Industry' by T. Ward, and the paper 'The Removal of Carbon Monoxide from Fuel Gases' by G. S. Cribb and J. D. F. Marsh.

At the end of the meeting Dr. J. G. King proposed an omnibus vote of thanks to those who had contributed to its success 'That it has been a successful meeting I am sure you will all agree.' Mr. W. J. Chadder seconded the resolution.

THE RESEARCH LUNCHEON

'The gas industry will come out on top'

Sir Dennis Proctor reviews industry's difficulties

'THE gas industry has a hard road ahead, and I know that the industry knows it,' said **Sir Dennis Proctor,** K.C.B., Permanent Secretary to the Ministry of Power, replying to the toast of 'The Guests' at the Autumn Research Luncheon at the Savoy Hotel. 'I am absolutely confident that it will come through its difficulties triumphantly. There is no complacency in the industry. It is full of fight. It knows that it must fight. It will fight, and it will come out on top.'

Elder statesman

Early in his remarks, Sir Dennis referred to the qualities which had caused the President to be regarded as 'one of the elder statesmen of the gas industry,' before turning to the gas industry in Scotland and commenting on the difficulties with which it is faced. 'Those difficulties are being met aggressively,' he asserted, 'and I have no doubt that they will be successfully overcome.'

He thought the President had referred a little modestly to the Lurgi plant at Westfield; but in their view at the Ministry, that was a development of first-rate importance and one that would be of the greatest interest to all members of the Institution, not only in Scotland, but in the rest of the country and, he would think, in other countries as well. 'It will be an example of the manufacture of gas under pressure and transmission of the gas under pressure from one big producing centre to the consuming areas. This may very well be one of the main patterns of the gas industry in the years to come. It is an example of the fact that in this sphere, as in others, pressure gets things done. That is, I know, one of the guiding principles of the gas industry under its energetic leadership which it has had for the last ten years.'

Sir Dennis said that the Lurgi plant at Westfield prompted him to mention the question of coke: 'The Lurgi plant is one of the processes—there are several other examples—of producing gas without producing coke. I know very well that the marketing of coke is one of the major problems of the gas industry, representing as it does under carbonisation methods a very important part of the revenue of the gas boards. In this sphere, we have quite recently had the promulgation of the new standard for coke by the British Standards Institution and I regard that as a very important milestone. The clean air policy and the growing demand for smokeless solid fuels represent a challenge to the gas industry which, I know very well, is being confidently answered. The issue of this British Standards specification is a very great step forward. Several area boards have already made arrangements for producing coke to this standard and marketing it, and I am sure that others will follow suit.

Not inconsistent

'In my view, there is nothing inconsistent between producing coke to the standard specification and producing premium grades of highly reactive fuels. Both are called for. Different consumers want both of them, and both of them should be energetically pursued. I hope, therefore, that all the area boards will follow that up, both that they will make their own arrangements for producing and marketing coke to the new standard specification, and also that others of them

will follow the enterprising example which has been set up by some of the gas boards in producing their own forms of premium fuels in the highly reactive grade.'

'These developments all represented practical application of the results of research, which is one of the main functions of this Institution. The nationalised industry, the area boards and the Gas Council do a lot of direct work in the field of research and education, but the functions of this Institution are an essential groundwork of that programme.'

Earlier in his speech, Sir Dennis had referred to the President's mention of 'the family of fuel,' in that he liked to think of himself as a friend and relative of the family. 'I welcome your remarks about family concord,' he added, 'because family rows can be very embarrassing to the relatives!'

Battling spirit

He concluded by paying a tribute to 'the battling spirit' of the industry's leader, Sir Harold Smith. 'Sir Harold has a burning faith in the industry's future and he has imbued us all with that faith, both those who are working with him in the industry and those, like myself, who have come into the family only recently. It is catching to be close to Sir Harold, as I have been for the last year, and it is inspiring. It instills in me the very greatest confidence. One of the main grounds for that confidence is, as I know Sir Harold himself would agree, that when he retires from the leadership of the industry at the end of this year, he will be handing it over to a man who is splendidly equipped to carry on the charge—my friend Sir Henry Jones.'

An occasion

In proposing the toast the **President** had referred to the fact that this was the silver jubilee of the Autumn Research Luncheon, an occasion on which it was natural to gather friends and relatives from near and far. In particular he welcomed M. R. H. Touwaide, General Secretary of the International Gas Union; Mr. W. Wood Prince, President of the Armour Company, Chicago; Mr. E. Battson, President of Constock Ltd., New York; Sir Dennis Proctor, Permanent Secretary of the Ministry of Power, the principal guest; and, also from the Ministry, Mr. Martin Flett, Deputy-Secretary; Dr. C. M. Cawley, Chief Scientist; Mr. J. A. Beckett, Under-Secretary, Gas Division; Mr. E. J. C. Dixon, Controller of Gas Standards; Mr. A. H. Norris, Assistant Secretary; and Mr. J. L. Warrander, the Ministry's Senior Scottish Officer. The President also welcomed representatives of the Ministry of Housing and Local Government, including Mr. Forshaw, Chief Architect, and Mr. Carter, Chief Alkali Inspector; from the Ministry of Labour and National Service Mr. R. K. Christy, Deputy Chief Inspector of Factories, and Mr. J. C. Stewart, Under-Secretary of the Employment Department.

This Autumn Research Meeting was in itself an opportunity for all of them to become a little better educated, he said, and the rôle which the Institution had to play in all educational matters was of the highest importance. It could not be successfully performed unless they had the willing help of so many people in many educational centres—in the universities, in the City and Guilds of London Institute, in the technical colleges and in the schools. It was of profound importance for the future of any modern industry that practical and theoretical training should go hand in hand in the development of its young employees.

Basic training

They had accordingly rephased their education scheme to meet the trend towards a functional organisation in the administrative structure of the industry and to meet the needs for some degree of specialisation in gas manufacture, gas distribution and gas utilisation, but always keeping in mind the need for basic training in fundamentals. This basic training was essential.

It was equally important in times of great change, in the technical as well as the administrative aspects of the industry, to cater for the interests of what might be called the 'middle strata' of technical staff. Thus they had organised refresher courses, the first being for station and works engineers and assistants. The object of these courses was to help those who may feel somewhat isolated from the new developments to overcome this feeling and to realise that each in their own sphere could contribute to achieving a really live and forward-looking industry. Their educational programme was designed to achieve this end, and their thanks were due to the many educationists who help us to discover the proper methods of doing so. They greatly appreciated the support given by Mr. A. H. A. Wynn, Scientific Member of the National Coal Board, and the Director and Assistant Director of Carbonisation.

The President also welcomed Dr. D. T. A. Townend, Director General of the British Coal Utilisation Research Association, Sir Harry Melville, Secretary of the Department of Scientific and Industrial Research, Mr. W. Donald King, Chairman of the Society of British Gas Industries, Dr. Reginald Bennett, M.P., the Acting Chairman of the Parliamentary and Scientific Committee, Sir Harold Hartley, Viscount Falmouth, past president of the Gas Research Board, Sir Robert Robinson, Professor F. H. Garner, Chairman of the Water Pollution Research Board, Sir Charles Ellis, Scientific Adviser to the Gas Council, Alderman Sir James Miller, former Lord Provost of Edinburgh, and Sir Josiah Eccles, Deputy Chairman of the Electricity Council.

Emancipated industry

The President continued: 'There is no doubt that the gas industry is more emancipated today than it has been for a long time, and I think we must all try to remember that in any family, when one member reaches a stage of emancipation, certain inevitable tensions occur. The normal family does not break up when this happens. It grows up. It adapts itself as a whole by understanding and giving due place to the rights and abilities of each of its members.

'Of course, there are scenes and arguments and, sometimes, painful adjustments, but in the end there is a new and stronger and more effective family. Today, in the family of fuel we are passing through one of those periods of domestic crisis. But I do not suppose that however cross each member may get with another member, any member would be foolish enough to think that the newly developed prowess of another member can be denied except at the cost of the effectiveness and well-being of the whole family. We have all got to learn to live together in a rapidly changing world.

Freedom of action

'If the gas industry is to play its full part for the good of the whole family of fuel, it must expand. It can only do so if it satisfies and retains its consumers. For this it requires freedom of action—a freedom sometimes denied it. It must be free to use any raw material which may become available. It is precisely because it is acquiring the new resources and skills to use these raw materials that it has this feeling of emancipation. But it must also strive for emancipation while preserving a due sense of responsibility for the interests of its fellow members in the family of fuel and for the best interests of the community as a whole.'

Meeting opportunities

He thought that they had been fortunate in Scotland in being able to take advantage of large new developments by working co-operatively together. The construction of the Lurgi plant at Westfield offered not only the opportunity to the gas industry of making gas at lower prices, but also the opportunity to the National Coal Board of developing the commercial possibilities of large quantities of small coal. This was only one of the ways in which the coal and gas industries had been able to co-operate in making the best use of indigenous resources to produce refined fuel. He had no doubt that in the future, further co-operation of this kind would take place, and with it the progressive emancipation of the gas industry from its too confined conditions in the past and its restoration to a larger place in the activities of the fuel and power industries as they strove to meet the present ever-growing demands for energy in refined forms. 'These must be met if the living conditions in our homes and the productive powers of our commerce and industry are to meet the challenge of the opportunities in the second half of the twentieth century.'

Mr. Sydney Smith, C.B.E., Chairman of the Scottish Gas Board, proposed the toast, 'The President.' Mr. Melvin briefly responded.

CHAIRMEN'S TECHNICAL COMMITTEE

New developments and the need for proper distribution of Institution recommendations

MR. E. M. EDWARDS (Chairman, Chairmen's Technical Committee) after presenting the report and summarising its contents, added that the technical committees of the Institution had had an extremely busy year.

He said they were entering upon a period of technological change that would undoubtedly have a far-reaching effect upon the future of the industry, and the work of the technical committees was therefore of increasing importance. He urged all those responsible to see to it that the reports and recommendations issued by the Institution were, where appropriate, always placed in the hands of those who would need to apply their contents.

Self-sacrifice

Mr. G. le B. Diamond (Chairman, Gasworks Effluent Committee), said he well remembered being present in 1928 at the presentation of the first report of the liquor effluent sub-committee under the chairmanship of Mr. C. F. Botley of Hastings, who did so much to initiate an investigation into the disposal of effluents. Mr. Botley's contribution was a notable example of a member of the profession taking a deep interest in a problem which troubled others but from which he himself was immune.

Since the days of Mr. Botley's self-sacrificing enterprise, Mr. Diamond went on, he should not be surprised to find that upwards of £250,000 had been spent on research and investigation up and down the country. In consequence, the industry had often been praised in high quarters for the initiative which it had taken.

On the other hand, there were some who said that the comprehensive technical papers that had been published over the past 35 years had tended to focus attention on the thought that the gas industry had a particularly pernicious and intractable material to discharge.

An immense amount of work had been done since those early days, in consequence of which it could be said with certainty that ordinary gasworks effluent liquor was not as bad as the name it had been given.

During the year, the Gasworks Effluent Committee visited Leeds and spent a day in useful conference with the members of the Gas Council's Effluent Committee and the Joint Research Committee of the Gas Council. Subsequently, a visit was made to Knostrop sewage works, where the pilot plant filters were installed under the Gas Council's research scheme. Arising from that visit, a small sub-committee had been set up to investigate and report on current knowledge of processes for the resolution of effluent liquor in the absence of sewage.

Much was now known about the undesirable constituents of liquor, thiocyanate, higher tar acids, fixed ammonia, phenol, and thiosulphate, and by suitable plant and works control some of the polluting load could be reduced. But on the other hand difficulties would arise in the event of a large gas-making plant being erected in some part of the country where the effluent could not readily be taken by a sewage disposal works. That was why the work of this sub-committee was of some importance.

In addition to steady progress with research work, some attention was now being directed to the intractable residue which was present in nearly all treated effluent, said Mr. Diamond.

Later on, in the proceedings of the meeting, Dr. Blackburn and his colleagues were to present a paper on 'The Effect on Effluent Disposal of the Electro-detarring of Hot Crude Gas.'

The result of this work had been a remarkable vindication of the theory preached by Mr. Alfred Britton of Hinckley for more than 30 years. He had never wavered in his self-imposed task, and through the barren years it was to be feared that he did not obtain may converts.

Mr. Diamond concluded by pointing out that the report of the Chairman's Technical Committee rightly paid tribute to the work of Dr. A. Marsden, who gave his services to the committee for so many years and had now retired.

Safety rules

Mr. T. C. Battersby dealt with those sections of the report dealing with the work of the Gasworks Safety Rules Committee and the *ad hoc* committee on electrical bonding.

During the year, the Gasworks Safety Rules Committee had accepted with regret the resignation of Mr. H. Johnston.

Last year, said Mr. Battersby, it was reported that discussions were taking place with H.M. Senior Electrical Inspector of Factories with regard to the use of electrically-operated instruments. Concurrently the availability of instruments to satisfy the requirements of various groups of gases had been the subject of discussion with representatives of the British Industrial Measuring and Control Manufacturers' Association. The conclusions were summarised in supplement 1 of the report.

Since the Chairmen's report was circulated, a letter had been received from the association intimating that a sub-committee of the leading manufacturers had been appointed specifically to deal with intrinsically safe and flame-proof instruments for industries. As the gas industry, through the Safety Rules Committee, had been the first to raise these problems with the Manufacturers' Association, the association now sought a further meeting. Later they proposed to meet the petroleum and chemical industries. The outcome of the discussions must lead to the manufacture of safer instruments, he said.

The committee had continued its review of accidents and fatalities which had occurred in hoppers and bunkers. The framing of safety recommendations had been a much greater job than was at first anticipated, but shortly it was hoped to submit recommendations to the Council.

Works discipline

At the request of the Council, consideration had been given to the desirability of preparing general advice in regard to 'no smoking' rules in gasworks. The committee was of the opinion that where a hazard existed specific reference was made in the various safety recommendations and that general advice was unnecessary. The enforcement of 'no smoking' rules was a matter of works discipline and must be dictated by local circumstances.

The gas industry, like other industries throughout the country, was becoming increasingly accident-conscious. It was pleasing to see in the annual report of the Gas Council that the accident rate for manual workers during the last year was slightly lower than in the preceding 12 months.

The committee wished to acknowledge co-operation from the area boards in submitting details of accidents. It was from a study of these reports that recommendations were framed.

The first two editions of *Unusual Incidents at Gasworks and Their Lessons* had been extremely well received and it was hoped that the third collection of incidents, which was to be published very soon, would be carefully studied by everyone responsible for the operation and maintenance of gasworks plant and

given the widest possible circulation among operatives.

On the purging of plant with inert gas, Mr. Battersby said that at the present time it was not suggested that I.G.E. Safety Recommendation P.1. should be amended. But it should be borne in mind that the recommendation was framed when there were many small gasworks in the country and purging with inert gas might have presented a problem. Most of the small works had now been shut down and the committee would like to stress the advantages of purging purifiers and other plant with inert gas when it was being put into or taken out of commission.

Recently the attention of the committee had been drawn to the hazards associated with liquid oxygen. These were quite different from the hazards normally met in the gas industry and in view of the developments which would employ liquid oxygen, a small panel had been set up for the purpose of accumulating information on the hazards associated with the production, storage and use of liquid and gaseous oxygen.

Mr. Battersby said members would recall that the *ad hoc* committee on electrical bonding was appointed by the Council of the Institution in February, 1957. An account of the work was given in the 19th report of the Chairmen's Technical Committee.

The report was accepted by the Council of the Institution and forwarded to the Gas Council which accepted the recommendations. Copies of the document were sent to the Institution of Electrical Engineers and the Institution of Water Engineers, and in March of this year representatives of the *ad hoc* committee met representatives of these Institutions.

The Institution of Water Engineers were now in a position to convey their views as soon as a joint meeting could be arranged.

Towards the end of October the Institution of Electrical Engineers had stated that the report was still before the Wiring Regulations Committee; it was regarded as a document of importance and complexity and they were not yet in a position to submit formulated views to their own council. In the meantime, however, they would welcome a joint meeting with the Institution of Water Engineers, presumably to get the views of that body before proceeding further. Steps were now being taken to arrange this meeting.

Electrical installations

During the discussions with the other Institutions attention was drawn to regulations for controlling the earthing of electrical installations to metal water pipes and water mains, which were drawn up and approved by the Institutions of Civil Engineers, Electrical Engineers and Water Engineers, the British Waterworks' Association and the Water Companies' Association. The existence of these regulations was unknown to the *ad hoc* committee, and for the convenience of gas engineers who might not be familiar with them, they were reproduced in supplement 2 of the report.

It was important to differentiate between the bond referred to in clause 5 of the regulations and the bond mentioned in the 18th report of the Chairmen's Technical Committee—Communication No. 511.

The Gas Distribution Committee recommended that wherever cathodic protection was applied to a gas distribution system, or where such a system was bonded to any other system cathodically protected, arrangements should be made to establish a bond across the pipe carrying live gas which was to be severed, to prevent a spark discharge and consequent risk of ignition.

To avoid ambiguity it would be preferable in their own regulations to refer to the establishment of a 'temporary continuity bond' across the pipe which was to be severed. This was quite different from the permanent bond referred to in the regulations for controlling the earthing of electrical installations to metal water pipes.

Gas distribution

Mr. F. L. Atkin (Chairman of the Gas Distribution Committee) said that apart from the exchange of information with foreign members of the International Gas Union, the activities of the committee had been mainly occupied with the following items:

Recommendations for the maintenance of gas governors used for distribution purposes.

Recommendations for the laying of steel gas services.

The external protection of steel pipes.

The first item had been completed and would be published as a document for inclusion in the I.G.E. Safety Recommendations and a supplement to the present report.

It would be noted that station governors had been excluded from the recommendations since they were referred to in other safety codes concerning gasworks, mentioning that it was advisable to purge with an inert gas during maintenance operations. It was considered by the committee that this was unnecessary on similar types of governors installed on the district where it was possible to obtain adequate ventilations and the absence of naked lights.

The rapid increase in bulk transmission mains, which were frequently used to supply districts en route, made it self-evident that great importance must be attached to preventative maintenance to ensure the continuity of consumer supplies. The committee also considered that it was most desirable to install permanent pressure recorders at such governors so that experienced observations of such charts would immediately indicate the advent of faulty operation. It was also important to place the maintenance examinations on a suitable rota for which appropriate forms were suggested.

With regard to gas service pipes, the committee had now completed their recommendations, which would be issued in the near future. The committee hoped that these would be used in conjunction with Communication No. 491, concerning mainlaying.

From time to time reviews of the broken mains statistics took place and it would be recalled that special forms had been designed for recording incidents created by gas escapes from mains and services with the ultimate object of pinpointing the most important contributing factors.

So far, said Mr. Atkin, it was quite clear that many accidents were caused by gas gaining access to premises through holes situated below ground used for the entry of public services. The committee thought it advisable to draw attention to the various codes of practice and regulations concerning this important aspect and these had been set out at length on p. 10 of the report.

It might be said that one local authority insisted on an inspection of the entry of public services into flats prior to the ground being filled in. It was hoped that, as far as it was prudent and possible, local gas board officials should draw the attention of other statutory undertakers to deviations from these codes.

With reference to the external protection of steel pipes the report was almost complete. The problem of the use of coal-tar dispersions or asphaltic bituminous materials was difficult to decide, especially in connection with small diameter service pipes.

The panel had received considerable assistance both from the makers of these materials and the users—steel pipe manufacturers. A great deal of information had been received from foreign sources, especially America, and it was clear that opinions were not unanimous on the relative merits of the two materials. Nevertheless, the committee felt that as a by-product of the gas industry, other things being equal, the use of coal-tar dispersions should be encouraged.

There would be difficulties in their use by the traditional means, but it was thought that these could be overcome. In this respect the pipe manufacturers were looking for a lead from the industry. It was hoped that the report would indicate the factors that would have to be considered.

Mains survey

Many area boards were actively engaged in the survey of mains and services using a combustible gas indicator in small hole drillings. Although the principles were the same various methods were being used and for some time the committee had under review these methods and the results.

During the coming year information would be assembled with a view to submitting a report on the results achieved by the survey and recommendations concerning the most economical methods of carrying out such work.

The Cast Iron Pipes Liaison Committee had met twice and had considered the issue, in conjunction with the pipe manufacturers, of a booklet on the best methods of transporting, handling, and storing cast iron pipes. This should be available in the near future, said Mr. Atkin.

Mr. H. B. Taylor (Divisional General Manager, Leicester), said the report of

the Gas Distribution Committee, read in conjunction with the earlier reports, indicated the impending completion of a very active spell of work, culminating in the promised publication on the maintenance of gas governors; the recommendations for the laying of steel gas service pipes; the earlier recommendations for mainlaying; the code of practice for gas service pipes; the recommendations for the prevention of accidents when cutting out gas mains for repairs and alterations; and the projected report on the external protection of steel pipes—all directed to the establishment of good and safe practices throughout the country and all particularly opportune, having in mind the attention now being paid to the training of distribution operatives. It appeared that the committee, having so well disposed of this essential work, would shortly be available for new assignments.

Over the past few years there had been an upsurge of interest in distribution engineering, as a result of which old methods and practices, many with roots in the distant past, had become subject to critical examination. The expanding use of work study was accelerating this trend. Increasingly the old ways were being replaced by new.

The Technical Committee of the International Gas Union was charged in the widest terms with the study of new gas distribution techniques. Should not their own Distribution Committee now turn to similar studies and so be in a position to assist the Gas Union with thoughts stemming from the base of the pyramid?

Novel technique

He had in mind developments by the area boards over the last few years. For example, one board had recently adopted a novel extraction technique by which service pipes of any length could be relayed with minimum disturbance of the surface of the ground. It had perfected a method by which stoppages in service pipes could be cleared manually, and of 17,500 services recently treated in this way over 90% were successfully cleared. The board had introduced a planned survey of all mains whereby they were examined for potential leakage at 6-ft. intervals. In two years some 3,000 miles out of a total of 9,000 miles had been surveyed and repaired where necessary. The recording of new and existing mains and services had been made effective. Similar examples could be quoted by other boards.

There was a need for an authoritative opinion on the many new materials becoming available—for example, ductile iron for gas mains and unplasticised P.V.C. for service pipes.

Mr. Taylor concluded that these would seem to be typical of the many matters which were of potential interest to the industry as a whole and, as such, might well be investigated by the committee. Was it not therefore opportune for the committee to become a clearing house for new techniques in the widest sense, rather as the Safety Committee dealt with 'unusual incidents'?

Mr. T. N. Dent (Area Development Manager, South Western Gas Board, and Chairman of the Watson House Centre Meter Sub-Committee) said that although there were two committees concerned with meters—the Institution's Meters Committee and the Watson House Centre Meter Sub-Committee—this did not mean that work was being duplicated.

On the contrary, he said, the investigations of the two committees were complementary, and it had become apparent that there was a vast amount of work to be done by both to achieve in the shortest possible time a reduction in the overall cost of metering and improvements in the overall efficiency and accuracy of meters.

The changing pattern of consumer usage, the increasing diversity of load resulting from the growing use of gas for central heating, even in the most modest households, and the changing characteristics of new types of gases now being distributed, would demand more and urgent research into gas metering practice.

Two problems under particular investigation were concerned with gas characteristics, said Mr. Dent. They were the effect of benzolised gas on the diaphragm dressings, and ultimately on registration, and the seepage of oil through stuffing boxes.

The latter problem was urgent, since it was believed that while half the meters brought in from the district for faults were found to be due to leakage, in turn about half of these were leaking at the stuffing box.

From its inception the Watson House Committee had concentrated on the preparation of a standard specification for domestic meters acceptable to both manufacturers and purchasers alike, and much of the committee's deliberations had been devoted to the problem of leakage from stuffing boxes and possible improvements in design.

The draft specification had been submitted for comment in all its stages both to the Institution's Meters Committee and to the meter section of the S.B.G.I. In no sense was it intended to restrict development, but set out only minimum requirements fundamental to sound meter construction.

More necessary

Furthermore, the lifting of restrictions on trade between the United Kingdom and the Continent would mean that meters from abroad would be more freely offered to gas boards in this country, possibly at lower prices than they were now paying for British-made meters, and a standard specification would therefore be more necessary than ever.

He did not suggest for one moment that Continental meters were in any way inferior to those made in this country—on the contrary, from what he had seen of the meter industry in France, he believed that in many ways they were ahead, particularly in the use of non-metallic materials which were almost completely resistant to wear and corrosion.

In this country the use of certain plastics, such as nylon gear wheels and graphite loaded bearings, was increasing, while experiments in the use of plastic diaphragms were in an advanced stage. But they still had far to go in this direction.

The Secretary read a contribution by Mr. W. A. Evetts (Divisional Engineer, Watford). So important had the recommendations become, wrote Mr. Evetts, and so often were they referred to as safety regulations, that one was tempted to say they should be called regulations, and that a date for their implementation should be laid down. These recommendations were not looked upon as such by the Courts, but treated as rules which should have been carried out.

The committee comprised experienced men occupying important positions who should be able to speak in the full knowledge that they would be supported by their boards.

Loopholes warning

The committee would have to be quite definite when framing the regulations and not leave loopholes which permitted non-compliance. It might be helpful if a proposed regulation was circulated to all area boards for comments before coming into effect, much in the same way as the British Standards Institution or codes of practice committee circulated their proposals before they were finally made.

The operating engineers in the industry—by that he meant works and distribution engineers—carried a heavy responsibility today in ensuring that the requirements of the Factories Act and the Institution Safety Recommendations were carried out, in addition to the daily round and common task of making gas by established and new processes. 'We hand them these ever-expanding volumes and say, in effect, see that they are implemented; the former are musts, the latter have not that same compulsion.'

If they must have permissive recommendations, could they not in future have regulations and recommendations?

If one studied one of the committee's latest recommendations for the safe installation, operation and maintenance of exhausters, gas pumping plant, governors and meters, there were, he thought, too many of the recommendations which were permissive. For instance, basements for pipe trenches should be avoided; buildings should be constructed of fire-resisting materials; buildings should be well ventilated and should be provided with an emergency exit; consideration should be given to the provision of a light-weight roof, etc. Under the same general recommendations when dealing with diesel engines, the committee were courageous enough to say that exhaust pipes must be gas tight and must discharge outside the building.

'On the other hand, I must hand the committee a bouquet for the speed with which they prepared their memorandum on installations for the use of light petroleum distillates in low pressure gasification plants. They could surely wish for no greater compliment than that which was evidenced by the pressure exerted on them by gas engineers to produce forthwith a set of recommendations for their guidance.'

Continued on p. 369.

EDUCATION COMMITTEE

THREE-STREAM EXAMINATION SYLLABUS FOR ASSOCIATE MEMBERSHIP NOW FINALISED

DR. A. E. Haffner, (Chairman of the Education Committee) said that the most important progress was the finalisation of the revision of the syllabus of the Associate Membership examinations. Earlier reports had made reference to the highly detailed work necessary to reorganise the Associate Membership examination on the basis of three separate streams—production, distribution and utilisation.

This at last had been presented to the Council in a form which received its approval last December, and the first examination would be carried out on this basis in October, 1962. Due consideration would be given to special problems arising during the transition.

It was not yet time to reprint the education regulations because the proposed changes and other proposed changes in classes of membership required sanctioning by the Privy Council. In the meantime the proposed changes were recorded fully in the report, so that young engineers and those responsible for their training might be aware of them and take them into account in their plans.

Graduate class

The details were in the report and the changes would implement the object of reorganising on the basis of three separate streams without sacrificing minimum basic knowledge in the other two streams. A new class of Graduate Member would also be introduced, one object of which was to mark progress made by those who had demonstrated their basic knowledge in each of the three separate fields.

Lectures delivered to young people continued to be popular. Measured in mere numbers some 10,000 youngsters must now have attended the London lectures and those organised by the district education committees.

Measured in localities, lectures had been given in some 17 cities and towns, where there were now young people who had a better impression of the gas industry or might even have decided to join it. It would be of interest to question new recruits to the gas industry to see whether their wish to do so was influenced by listening to one of these lectures.

The short course for teachers organised by the Ministry of Education was held, with the traditional support of the host Board, this year at Lodge Hill, Pulborough, and proved to be as popular as ever.

It had in recent years been confined to teachers of gas fitting and aimed at giving them guidance in interpretation of syllabuses and acquainting them with new proved techniques in teaching. Teachers of other gas subjects were patiently awaiting their opportunity of taking part in such a course.

Sandwich courses, four in England and one in Scotland, were playing a dominant part in fitting selected recruits for their responsibilities. It was deemed wise to acquaint the colleges concerned with the proposed change in the syllabuses of the Associate Membership. Not that sandwich courses were directly based on the syllabuses. But they were used as a yardstick in approving courses as leading to exemption from the Associate Membership examination.

Accordingly, a conference was arranged, and attended by principals of colleges, heads of departments, and those members of the education committees, including education officers, most directly concerned with sandwich courses and syllabus revision.

There seemed to be no insurmountable difficuty in meeting the requirements of the increased syllabus content, for indeed the colleges were already beginning to think in terms of four-year sandwich courses with an eye to the possibility of attaining recognition for Diplomas in Technology.

Clearly, some localisation of selected streams seemed highly desirable to avoid the decay that would arise from lack of support of 12 or 15 separate courses, if each of the four or five colleges tried to run each of the three streams.

Unique approach

Sandwich courses had grown phenominally over the last few years and the conference had given opportunities for a fundamental review. Potentially a sandwich course not only aimed at providing a fairer and more humane training than part-time study, but also provided a training with a unique approach.

It was not entirely a substitute for a degree course.

Those at the conference were anxious to improve the integration of the two parts of the sandwich and industrial training came in for more criticism than the academic.

As a practical outcome of the conference, a committee had been formed to make recommendations for a model industry training scheme suitable for integration into a sandwich course.

It was no more than wise annually to ask the question, 'Is the effort being devoted to the Institution examination system justified?' Many busy people gave a lot of time to that cause. Measured in numbers it could be said that 67 candidates had taken the main subject examination compared with 50 the previous year. The relative importance of the sandwich course was shown by the 16 who passed at Salford, seven at Birmingham and one at Enfield. '(I ought to add that the one at Enfield represented 100% efficiency; only one candidate entered.)'

Indirect standard

The numbers attending sandwich courses in the year under review had been 184 compared with 154 in the year before. Sandwich courses were likely to increase their output, for there were large numbers in first and second years, and the effect of Westminster Technical College and Heriot Watt on the final year had yet to be felt. Nevertheless, although sandwich course students were likely to increase in number relative to those taking the Associate Membership examination, the latter served at least as an indirect standard for sandwich courses.

Eight gas engineers had taken part in a repetition of a course on steam and power engineering organised by Allens of Bedford, and, Dr. Haffner said, he had gained a very favourable impression, which was supported by the participants, when he called to see the course in action.

Dr. Haffner concluded: 'Strictly speaking, I should be confining my remarks to the year under review, but I cannot resist the temptation to announce that a refresher course for station engineers and their deputies will be held at Pembroke College, Oxford, from April 4-9, 1960. This springs from a suggestion made by Mr. Hutchison, who has taken a close interest in the subsequent arrangements.

'It is hoped that station engineers will benefit from the week's withdrawal from their multifold tasks to listen to lectures by well-known figures in the gas industry dealing with recent developments in honest-to-goodness engineering, and by arguing with their colleagues in free and perhaps fiery speech.'

To outraged distribution and utilisation engineers who might have felt that they had been neglected, he said it was hoped their needs would also be met by organising the refresher courses on a three-year cycle.

Mr. L. F. Randall (Chairman, Sales Training and Consumer Service Committee) said that he was very pleased to report that again this year the number

of candidates sitting for the written examinations had been maintained, and, in fact, the total of 126 was the highest number yet recorded.

The Sales Training Committee had not met during the year under review, but this was due only to the fact that the pattern of the written examination had been found satisfactory.

It had, however, been found useful to hold at least two meetings of the oral examiners. The first meeting was held prior to the examinations so that they might discuss the most suitable method under which the examinations should take place. By having this meeting not only were the examiners helped to approach their task, which changed year by year according to the progress the industry was making on the sales side, but also a reasonable measure of standardisation could be introduced, so that candidates found that regardless of the centre at which they were examined, the arrangements were approximately identical.

While it was encouraging that the number of candidates had been maintained, Mr. Randall suggested that this number was still disappointing, bearing in mind the increasing part which sales and service must continue to play in the industry. Referring to the use of agents, dealers and other organisations, Mr. Randall said: 'Whatever the outcome, one cannot but assume that those members of the board's staff who are in contact with the public must always combine sales with service if the maximum benefit of their employment is to be obtained. Those arrangements do not rule out the possibility of the employment of specialist salesmen, but rather recognise the fact that, because we are so dependent on sales, every employee whose duties might primarily be associated with the service side of our industry has always the opportunity to sell. If our staff are trained correctly these opportunities will not be missed.

Sales without service

'The position was, I thought, very aptly described in a terse notice which I saw in a district office of a gas company in the United States. The notice ran as follows: "Service without sales will get you no place. Sales without service will get you trouble."'

Mr. J. E. Cooper stated that it had been the general feeling of the examiners that the quality of answers had not been sufficiently high.

He had noticed that in the report the word 'patchy' had occurred in the two parts. A paragraph indicated, apart from patchiness, another serious lack.

His quotation was: 'Where fundamental knowledge was required to answer the question, often there was no response, and it must be assumed that the intake of information by some candidates was seriously lacking.'

The words in the report had not been written lightly. 'In fact,' he said, 'we as a board feel that it is our duty to give all possible help and support to the candidates whose work we are marking, and this time it appears sad to us that when our industry on all sides is becoming much more complicated, and therefore in need of the highest technical brains, we have to make this somewhat doleful report to the meeting.'

About teaching, Mr. Cooper said some little time should be given to instructing candidates how to marshall facts and answer a question. It was surprising how often the candidate branched off to some remote topic.

He was glad something had been done about the syllabus. As it stood in the year under review, it seemed an impossible task for anyone to be other than patchy in his knowledge.

Examiners were appointed for three years, however good or however bad they might be. He suggested that this side of the scheme be looked at again. He was sure there were some examiners who, at the end of the third year, were beginning to get a slight understanding of the task and would be extremely useful servants if they were allowed to continue.

Particular difficulties

Mr. F. Caunce (Inspector, Ministry of Education) said they had very much in mind the particular difficulties of those left outside the sandwich course scheme. To some extent these difficulties were reflected in the rather poor standards indicated in the report, and were possibly a reflection on the students who were left out of such courses and also the difficulties of teaching them. 'It must be remembered, I think, that in the part-time technical college course mainly the students are those who have already been selected by their employers, and the teacher must do the best he can with the material which is sent to him.'

The sandwich courses, he went on, might possibly, in one or two instances, develop into Dip.Tech. courses. This was now being discussed, but there was one aspect to consider. There were, in the Institution's arrangements, a number of research scholarships given to students at universities. If and when a Diploma in Technology course was established the research scholarships could be extended to students who could follow up projects in the appropriate college of advanced technology, and so give a complementary type of individual to those coming through from the universities.

Replying, Dr. Haffner said Mr. Cooper's depression was experienced by every board of examiners. There was something constant in the depression with which they approached their task. At the same time, he had appealed for consideration to be given to the examiners continuing for more than three years. He had referred to them as some being good and some being bad, but Dr. Haffner reckoned they were all good, because they were chosen after a very careful appraisal of their experience. 'But it is a race,' he said, 'between accumulating experience and increasing depression, so that if at the end of three years an examiner had become so thoroughly depressed, the experience would be no good to him. It would need the judgment of Solomon to decide at what stage an examiner is at his best!'

The development towards the establishment of Diplomas in Technology was one in which the Institution itself could not play too dominant a part. It must wait for natural developments to take place and for the need and the appreciation of the need to arise independently of any prompting by the Institution.

Nevertheless, the Institution was absolutely ready and alert to collaborate as soon as this appreciation had been established.

Readjusted advice

Mr. Caunce's suggestion that existing scholarships should be diverted to the new Diploma in Technology was of great interest. Constantly the Education Committee was having to readjust its advice as to how to deal with these scholarships.

The scholarships were founded in many cases many years ago when there was clearly a specific need. Changing circumstances, however, sometimes made it difficult to place suitable candidates for them and it might well be that Mr. Caunce's suggestion was one that would be well worth while following up.

CHAIRMEN'S TECHNICAL COMMITTEE

Continued from p.367.

Mr. Edwards, replying to the discussion, said Mr. Taylor, particularly when speaking of the Gas Distribution Committee, had referred to a clearing house for new techniques. In effect, that was happening now, but perhaps rather quietly and steadily. The point was one that would be given particular attention by Mr. Atkin.

In this country the use of gas at pressures in excess of 100 lb. per sq. in. had been rather limited, went on Mr. Edwards, and as new installations were developed where gas was transmitted at 150 lb. per sq. in. or more, new conditions were emerging and the whole subject became very important.

It became especially important that men in the field should be aware of the regulations and recommendations, because they really had a new job to learn. In his experience, accidents had almost always been due to the men in the field not being fully briefed with the information available.

In Mr. Evett's note, particular reference was made to his opinion that safety regulations should be called 'regulations' and a date for their implementation laid down.

This point would receive the special attention of the Institution Council because a very wide principle was involved. Personally, he was more in favour of government by consent than government by yet more regulations, but that was a matter which must be looked at very closely.

FIFTIETH REPORT OF THE

JOINT REFRACTORIES COMMITTEE

THE first paper[1] in the report deals once again with flaking in continuous vertical retorts and opens with an account of a number of field observations made during the last 12 months.

The superior resistance to flaking of siliceous material compared with silica in some installations, and its inferiority in others, has not yet been fully explained, and another instance of this difference has recently been seen.

That low-rank coals do not cause flaking has received support from the continuing immunity of a setting of continuous vertical retorts, in the London area, which have now been in operation for over 1,000 days on low-rank coals at 50% above nominal throughput for the works. This high throughput probably brings down the internal retort temperature below the usual level, and the smooth coal travel that must necessarily be associated with such a throughput will make for steady wall temperatures.

Unanswerable

The apparent absence of flaking in Scotland continues to raise questions that at present cannot be satisfactorily answered. It has been suggested that Scottish coals in general are low-rank coals and behave in the manner just outlined. The validity of this explanation is difficult to assess at the moment, but it must be noted that some Scottish gasworks carbonise coals of swelling numbers 3 to 6 and have light or negligible flaking, whereas the same swelling characteristics are occasionally associated with moderate to heavy flaking in England.

Information derived from visits to Scottish works and from the survey of scurfing practice does not support the opinion that operating practice in Scotland is exceptional in any way. Data on the properties of scurf samples from a number of sources are presented, and may be taken as indicating that none of the (measurable) relevant properties show characteristic differences that might be related to the severity of flaking.

An interesting feature of the first paper is the first interim report on the progress of the flaking trials. An opportunity arose to examine a group of retorts containing the five trial materials, after 18 months' working, and it was found that flaking had progressed far enough to reveal distinct differences between the individual materials. Experience suggested that low porosity, low permeability, and great strength would be the ideal combination, but, if one now examines the end members of the order of merit, it is found that the best material has only slightly less than average porosity and permeability, and the lowest compressive strength, whereas the worst material is appreciably lower in porosity and permeability than the best and is the strongest of all the five.

One is now in the stimulating position of having two materials under one's hands, one of which flakes less than the other because of some difference in a property not yet identified. This difference should form an excellent starting-point for a further search for the cause of flaking.

The second paper[2] in the report is an account of a short investigation of the influence of temperature in the scurfing operation. The combustion of scurf appeared to be easy to investigate in the laboratory, with real scurf as the subject, and the answer apparently comes out clearly—the temperature can be dropped before a retort is scurfed, without further loss of operating time, provided that the air supply is adequate. Nevertheless, the results obtained are extremely provocative from the point of view of the physical chemistry involved.

The apparent independence of the rate of burning on temperature is puzzling, and, while this may be involved in an obscure way with the diffusion mechanism, it may be that the temperature at which the reaction is occurring is not that of the furnace, but is determined, as an equilibrium temperature, by the geometry and thermal characteristics of the test piece. The work is, therefore, being extended in the hope of clearing up this apparent anomaly.

Impressive data

The third paper[3] is an extension of last year's survey of scurfing practice in continuous vertical retorts and represents an attempt to put on a firmer and more general basis the conclusion then reached that none of the methods of scurfing in use on the works studied had any discernible effect on the rate of flaking. With the co-operation of the area gas boards, information has been collected by means of a questionnaire from 103 gasworks operating a total of 113 settings. (The replies are tabulated in the paper.) The information covered a wide range of operating factors and procedures, and formed an impressive mass of data when it was assembled. A statistical analysis was out of the question because of the number of variables involved and because much of the information was not in metrical form, and an analysis by inspection has been made.

Nevertheless, a few fairly definite conclusions have been reached, and of these the most important is that none of the methods of scurfing in use seems to have any effect on the rate of flaking.

It would be presumptuous for the authors of this report to attempt to make a choice among the modern methods, for many operational factors are involved and there is probably no universally 'best' method. It is for the engineer on each works to decide by experimentation which method gives the fastest scurfing with safety under the prevailing conditions. It is perhaps a fair comment to say that the improvements in scurfing methods that have developed during the years have now resulted in a fairly circumscribed range of techniques within which variations in method have produced little that is significant.

It was hoped that the collected operational data might throw some light on the problem of flaking, and more particularly on the question discussed in the first paper regarding the absence of flaking in Scotland. In fact, the survey has tended to discredit the two explanations previously offered, (i) that operating temperatures are lower in Scotland than elsewhere, and (ii) that Scottish coals are generally easier-travelling than English coals. It seems to be established that no single factor, or simple combination of factors, is responsible for observed differences in flaking behaviour.

Two objectives

The movement survey recorded in the fourth paper[4] was undertaken with two objectives: The first, to obtain information on the vertical and horizontal movements of benches of continuous vertical retorts, and the second, to search for a relationship between expansion movement and leakage. The second was prompted by the success that attended the search for a similar relationship in intermittent vertical chambers. No such success has attended the present survey, but this is perhaps not wholly unexpected in view of the fundamentally different structure of the two systems. (The paper covers observations over a period of five years.)

The actual movements recorded can be appreciated only by means of diagrams, but it can be stated that the vertical expansion conforms closely with what might have been predicted from the known thermal expansions of silica and siliceous bricks. The lateral expansion conforms also to an expected temperature régime, in which the base and head of the retorts are cooler than the median zones, thus imposing a bulge on the structure. (The closure of expansion spaces is briefly reported upon.)

The fifth paper[5] is an interim report on the trials of iron-spotted silica bricks that are in progress in a number of in-

stallations. The first part of the paper deals with bricks that have been in use for approximately two years in the walls and flues of a battery of coke ovens. Since this period is barely one-tenth of the expected life of a coke oven, it would be unwise to draw any far-reaching conclusions from the present condition of the iron spots.

From an examination of the iron spots, first in the ovens and later in the laboratory, it can be said at once that in these ovens they have not acted as centres of attack by slag or as catalysts for carbon deposition from hydrocarbon gases. Iron spots have in the past been suspected of both these activities. Only minor changes in the spots have occurred after two years—a slight enlargement of some of the cavities by rounding of their edges in spots on the working face, and a slight spreading of the stains by diffusion. Neither effect would appear to be a cause for anxiety.

The second part of this paper is an interim report from the engineers in charge of the works where iron-spot trials in gas retorts are in progress. These trials have been running for approximately two years and one cannot expect any definite results yet. The report strikes an encouraging note, however, ending with the statement: 'So far, no differences in performance have been reported between material with or without iron spots.'

Refractoriness test

The laboratory progress report[6] records the continued study of physical properties and methods of testing. Considerable attention has been given to the refractoriness test, and a method of remote indication of cone squatting has been developed that permits the use of a closed furnace and removes the personal factor from this test. It would be encouraging to regard this, and similar methods now being investigated, as a step towards a new outlook on the refractoriness test. Co-operative study of the refractoriness-under-load test continues and, indeed, must continue until agreement between the different laboratories is secured.

A particular study has been made of the principles underlying the measurement of permeability, and a number of uncertainties have been cleared up. A new investigation has begun into the measurement of grain porosity. Elasticity studies in various materials have been extended up to 1,000°C: A characteristic of silica brick seems to be the drop in elasticity of some 30 to 40 per cent between 20°C and 200°C, followed by a general rise to 1,000°C, when the elasticity is some two or three times the value at room temperature. Corresponding changes in modulus of rupture suggest that the critical strain to cause breakage is greatest at about 200°C and falls fairly rapidly above this until in the region that is critical in the flaking problem, namely, 800° to 1,000°C, the strain to cause breakage is only about one-third of the cold value; a new factor that might bear on the problem of flaking.

DISCUSSION

Mr. J. Laming, Pickford, Holland & Co. Ltd., said: In the introduction to part II, the authors mention two theories of flaking, the differential expansion theory and that of Wylde who considers that curling scurf exerts sufficient force to cause flaking during scurfing.

I should like to point out that the theory of differential expansion between scurf and refractory was originally put forward by Dr. Heaton in 1947. Laming's work merely added to Heaton's ideas and demonstrated that differential expansion effects did, in fact, occur. None of the field observations on flaking made during the past year are inconsistent with the differential expansion theory.

Perhaps the most interesting item is the interim report on the progress of the field trials on flaking. There is rather more than a suggestion that bricks having a high ultimate strain are more resistant to flaking than bricks with a low ultimate strain. It would therefore seem that, in the earlier and cruder trials, the two bricks of low permeability that resisted flaking had by coincidence higher values of ultimate strain than the normal material.

The idea that ultimate strain might play some part in flaking is not new. Heaton in 1947 in a mathematical treatment of the differential expansion theory, suggested that the ultimate shear strain of the refractory is an important factor in determining the degree of flaking. It should be noted that no new mechanism of flaking is required by these latest discoveries. Either of the current theories of flaking will provide a plausible mechanism; the ultimate strain value of the refractory material is merely the factor deciding whether flaking does or does not occur.

Order of purity

One is led to speculate on the origin of differences in ultimate strain. The order of merit for resistance to flaking is also the order of purity. Is glass content then the controlling factor, and may we expect that in a few years' time the gas industry will be competing with the steelmaker for super-duty bricks?

The authors, in discussing the relative absence of flaking in Scotland, observe that the traditional reasons given for this immunity are invalid. They find that operating temperatures are not lower in Scotland and that not all Scottish coals give free travel.

I should like to remind them of the observations of Dr. A. E. Haffner who has stated that a relationship exists between the incidence of flaking and the c.v. of the made gas. The authors have stated in part III that there is no discernible relationship between c.v. and flaking, but at least one gas engineer, quoted on p. 52, and myself suspect that there is. Superficial examination of data presented in part III reveals no pattern, but it might be rewarding to feed this data to a computing machine.

With regard to part III, which deals with the influence of temperatures on the rate of burning of scurf, the results of this investigation are interesting in that they reveal an apparent anomaly, i.e., that temperature in the range 900-1,200°C. does not materially affect the rate of burning of scurf. I should like to suggest that the apparent independence of temperature may result from the increasing viscosity of gases with rising temperature. This must result in a compensation reduction of air flow near the retort wall (or test piece) as the temperature rises.

Verified tests

Part V deals with a movement survey on continuous vertical retorts. One of the conclusions reached in the paper on the movement survey is that expansion joints do not close. I can confirm this observation for other retort settings and indeed for furnaces of many types. These observations suggest that:

(1) The structural steelwork is not sufficiently rigid and does not exert enough force to overcome the friction at sliding joints; and that since expansion joints do not always close,

(2) Expansion joints may not be necessary.

On part VI, which deals with iron spots, it is gratifying to a laboratory worker to find that results predicted from laboratory tests are being verified in practice. I venture to suggest that in a short time only one bone of contention between manufacturer and user will remain; that is, the question of who shall fill the iron spot cavity with cement, the brickmaker or the bricklayer.

Mr. T. Bispham, North Thames Gas Board, said: In part II regarding flaking in continuous vertical retorts, two tendencies emerge, the general freedom from flaking when carbonising low rank coals, and the more marked flaking of silica compared with siliceous material. These findings confirm experiences in the North Thames Gas Board.

The former is presumably due to the fact that coal throughput can be increased appreciably at similar combustion chamber temperatures with low rank coals, and there is likely to be a lower coal face temperature in the retorts. The experience in one such retort house in the North Thames Gas Board is that an extended scurfing cycle can be worked, and even so the scurf is burnt off more quickly than with normal gas-making coals. There is no apparent flaking of

REFERENCES

1 'Flaking in Continuous Vertical Retorts. Further Field Observations and Laboratory Experiments,' by L. Sabiston and J. F. Clements.

2 'The Effect of Temperature on the Rate of Burning of Scurf,' by L. Sabiston.

3 'Scurfing Practice in Continuous Vertical Retorts. Part II—An Extended Survey,' by L. Sabiston and J. F. Clements.

4 'A Movement Survey on Continuous Vertical Retorts,' by J. F. Clements and L. Sabiston.

5 'Iron Spots in Silica Bricks. Part III—Interim Reports on Field Trials,' by L. Sabiston.

6 Progress report of other investigations.

the silica, and practically no rodding is necessary.

It is interesting to note that a Scottish works has undertaken to carbonise high rank English coals. It is suggested that some years will be necessary to assess the effect of flaking. Need this be so? Flakes have become detached from silica retorts carbonising unscreened Durham coal as early as the first scurfing, and an indication of severity of flaking should become apparent at an early stage.

An upward-controlled method of scurfing was described last year. It was then stated that scurf could be burnt off at a considerably reduced temperature provided that sufficient air was available. This method has been in use for some 18 months now and the siliceous retorts show practically no flaking. The extended trial fully confirms the fact that scurf burns off as quickly as in the downward diffusion method used previously at higher temperatures.

It is pleasing to see that in part III laboratory experiments confirm that scurf will burn off under these conditions if sufficient air is available. This method is now in general use in North Thames Gas Board stations in a variety of circumstances, and it will be interesting to watch developments.

Part IV dealing with the survey of scurfing practice suggests that there is no clear indication linking up scurfing methods with severity of flaking but again the stress turns to type of coal, type of refractory, and general carbonising practice.

Increased life

It is of some interest that for other reasons, less run-of-mine Durham coal is being carbonised in North Thames Gas Board continuous vertical retort houses. Increasing amounts of low rank coal are being used for Cleanglow manufacture, other rail-supplied stations use Yorkshire nut coal, and even riverside stations are to some extent changing to Durham nut coal owing to its better travel and higher thermal output. This is tending to give an increased life to the retorts.

In this section of the report frequency of rodding is mentioned. This subject is important if frequency of rodding means necessity for rodding. If the absence of flaking when using low rank coal is due to low internal temperatures, and lack of fluctuation, any irregularity of travel may help to cause flaking.

Equally, if flaking starts, irregular travel will result. This factor is being considered in the North Thames Gas Board, and it has been found in one retort house that while offtake temperatures are reasonably steady with hourly rodding, temperatures fluctuate considerably if the interval is increased to two hours. The bench in question comprises 40-in. elliptical retorts working on Durham nut coal. The varying frequency of rodding necessary in different retort houses is not always readily explained, and more investigation of this feature is desirable.

Mr. M. Sinclair Gaskill, West's Gas Improvement Co. Ltd., said: One feels considerable sympathy with anyone who is faced as the authors of part IV with what can only be described as a mass of information and fully appreciates the difficulty they experienced in attempting a statistical examination of such information.

Work of a similar nature, although on a very much smaller scale, has shown the difficulty of correlating and drawing conclusions from information obtained from even a limited number of observers. Particularly is this the case when the data supplied does not depend on actual measurement in some form but is of necessity based on observations and is obviously subject to the personal opinion of individual observers.

In some cases even when data is based on measurement it is possible to arrive at misleading conclusions from information based on reports of different operators using different instruments. In this connection I would cite the instrument most frequently used in retort houses, namely, the optical pyrometer.

Experience has shown that the accuracy of such instruments can deteriorate considerably over a period without the operators being aware of such deterioration. It is perhaps not irrelevant at this juncture to emphasise the necessity of frequent regular and efficient checking and recalibration of such pyrometers. It is obviously impossible in a short contribution to the discussion to examine the wealth of information collected and recorded in section IV, and I would therefore comment briefly on the conclusions given in p. 52.

While one must agree that no single factor is responsible for observed differences in flaking behaviour, it is suggested that the implication of the statement 'that the method of scurfing has no discernible influence on the rate of flaking' might be dangerous. There is little doubt that methods of scurfing which lead to excessive temperatures at the scurf/brick interface may cause considerable damage to refractories.

I would agree that, as stated, flaking is probably initiated during the working period and that the removal of scurf may be mainly contributory but would suggest that this contribution may be considerably increased by the method of scurfing.

In a similar manner section IV of the report on the effect of temperature on the rate of burning of scurf might give rise to doubtful conclusions. The rate of burning is said to depend solely on rate of supply of air, and is unaffected by temperatures in the region 900°-1,100°C.

Information needed

The authors are obviously somewhat unhappy about this statement, and the experiment is being extended in order to obtain more information. In the experiment reported, the temperature shown by the thermocouple will have been influenced by both the burning scurf and the furnace wall. Before any practical application is possible, information is required concerning the temperature of burning scurf, particularly at the scurf/brick interface.

In this connection, of course, the effect of velocity of gases and the cooling effect of the air flow up the retort will be of importance. Also the temperature to which the air is raised during its passage through the retort before reaching the point of combustion with the scurf may have an effect on the temperature at this point.

While the results of the survey may appear somewhat inconclusive, a study of the report gives what might be described as an outline indicating that certain coals, methods of operation, calorific value of gas, and type of refractory tend to give rise to flaking.

It is suggested, in addition, that whatever theory of the mechanism of flaking be considered, a critical temperature or temperature range exists. In this connection, the effect of leakage from the retorts and the consequent local and possibly intermittent temperature effect should be considered. Leakage is a function of pressure conditions in the retort arising from the type of coal carbonised, not necessarily a high swelling coal, and the method of operation.

The effect of calorific value of the gas in this connection is obvious. With reference to the type of refractories, retorts built of siliceous material are generally less subject to leakage than those constructed of silica, and this may account for the difference in behaviour of these materials when carbonising the same coal, as reported in section II, p. 6.

Puzzling feature

The report on the 'Movement Survey on Continuous Vertical Retorts' is also extremely interesting and merits careful study. It has confirmed the fact that leakage does not appear to have any connection with setting movement, that is during the working life of the settings, as distinct from the heating-up period.

The authors mention the puzzling feature of the delay in the appearance of leaks in elliptical retorts. It is suggested that this delay occurs irrespective of the shape of the retort. We have investigated very fully the possible effect of the type of coke extractor and have reached the conclusion that this has no bearing on retort leakage.

It is suggested that a distinction should be appreciated between when leakage occurs and when it becomes apparent.

Movement of the retorts during heating-up may give rise to what might be described as potential points of leakage in joints. The passage of gas through such points of leakage may not be apparent until as a result of this gas flow the width of the fissure permits an observable leak, hence the delay mentioned by the authors. I would therefore submit that further investigation on the subject of retort joints and jointing material would be of considerable value.

Mr. T. R. Lynam, Oughtibridge Silica Firebrick Co. Ltd., said: I should like to deal particularly with the section relating to iron spots. Incidentally, I should like to express thanks for the provision of the very useful German translation. I hope that this is the last occasion on which a representative of the silica manufacturers will rise to ask

you to do something tangible with regard to this question of iron spots.

First of all, let me hasten to say, and I am convinced that other manufacturers will support me in this respect, that we do not expect you to accept bricks with holes in the iron spots. This work has been very useful in showing what fillers will do in this respect, but if you accept one type of hole or fissure, then there are many other types to be considered as well.

No, we expect action with regard to iron spots as such, and we would no longer expect bricks to be rejected for iron spots on other than the working face of the brick; and although a tentative acceptance is in operation at the moment, we feel that a sub-committee should be formed to decide on the maximum size and the number of iron spots which would be acceptable on the working face of a brick.

Dr. T. H. Blakeley, the Morgan Crucible Co. Ltd., said: As the Institution's Gas Research Fellow nearly 30 years ago, I was engaged under the direction of Professor Cobb on a study of gasification of carbon in carbon dioxide. Quite recently, I reviewed this work again in preparing a paper for the Carbon Conference at Buffalo this year.

In doing so, I gathered the impression from my old work, and from the fairly voluminous literature now available on carbon gasification, that some broad correlations could be deduced which appeared to reconcile much of the available data, especially at higher temperatures and rates of gasification. I have found it interesting to review Mr. Sabiston's work on the combustion of scurf in the light of these correlations.

At lower temperatures—below about 600°C. when oxygen is the gasifying medium—the rate of reaction is governed by the chemical properties of the carbon, and by the temperature, and is independent of gas velocity. Above about 900° for oxygen at low gas flows (but as high as 1,700° for high gas flows, as in rockets), temperature has little or no effect, chemical nature of carbon is of minor importance, and gas velocity is the controlling factor. Between these two temperature limits is an intermediate regime, in which the rate of reaction can be calculated mathematically.

Negligible effect

This calculation we need not worry about here, because all the conditions used by Mr. Sabiston are shown by our correlation to be almost certainly above the intermediate temperature range, so that, as shown by the author, temperature has a negligible effect on reaction rate as compared with gas velocity.

The temperatures to which I refer are those of the actual carbon surface; at high oxidation rates, as all gas engineers will know, this temperature will greatly exceed the ambient temperature. Neglect of this factor makes difficult the correlation of experiments in which carbon temperature (measured optically), temperature between carbon sample and furnace wall and gas temperature before or after the carbon sample, may all be used by various workers—with very different results and conclusion.

Within the velocity-controlled conditions it appears that, as an empirical correlation with some theoretical backing, gasification of carbon in a variety of gases might be represented by

$$R = .15\,P\sqrt{\frac{V}{d}}$$

where R = gasification rate, in mg. of carbon per sq. cm. per second.

P = partial pressure of gasifying medium in atmospheres.

V = ambient gas velocity in cm. per second.

d = characteristic dimension of carbon body (e.g., diameter) in cm.

Mr. Sabiston's gasification rates as observed are all lower than the rates calculated by this equation for partial pressure of oxygen of .2, by a factor which varies from about 3 at 5 litres per hour to 2 at 20 litres per hour. However, as Mr. Sabiston points out, the partial pressure of oxygen fell quite markedly in his experiments. An attempt has been made to correct for this effect on the assumption that the effective partial pressure in these experiments was the geometric mean of the initial and final partial pressures. The use of this correction gives virtually exact reconciliation of the observed and calculated results.

Reduced air flow

The control of scurfing rate by controlled admission of air is illustrated by the formula quoted. Reduced air flow retards scurfing by the reduction in gas film thickness (i.e., reduced gas velocity) and by reducing the partial pressure of oxidising gas.

Oxidation by oxygen only has been considered in this contribution, and the temperature has been shown to have little effect above 900°. For steam, however, the low-velocity intermediate temperature range is higher, probably about 900 to 1,400°C. (as compared with 600° to 900°C. for oxygen). One would therefore not be surprised to find that temperature had a greater effect on scurfing rate when steam is used.

Dr. N. F. Astbury said: May I take two points? My colleagues who have been directly responsible for the work will make the main reply to the discussion in writing.

Ultimate strain

Mr. Laming mentioned the question of ultimate strain, and I perhaps might have said in this connection that the significance of this or any other physical property which can be correlated with flaking should lead us to consider whether, if it is a relative property, we can tailor it into the brick. If ultimate strain is the answer, if we want a brick with high ultimate strain, then we have to ask ourselves whether we can tailor this into the brick; and I have an uneasy feeling that this may mean a little more glassy bond with the brick.

That is why I was rather disturbed when he mentioned glass. I would like to remind Mr. Laming that his remark about viscosity is well taken care of, because you cannot analyse these diffusion control processes unless you do.

I would like to thank Dr. Blakeley for his most illuminating and lucid contribution to the scurf burning problem, and offer a small point in our own defence. On pp. 5 and 6 of the printed introduction we say that the temperature at which the reaction is occurring is not that of the furnace, but is determined, as an equilibrium temperature, by the geometry and thermal characteristics of the test piece.

DUTCH NATURAL GAS AGREEMENT

THE Nederlandse Staatsgasbedrijf and the Koninklijke Nederlandsche Hoogovens en Staalfabrieken N.V., Ijmuiden, Holland, have concluded an agreement relating to the supply of about 7 mill. cu.ft. of natural gas per 24 hours over a number of years. This gas, derived from the oil wells in the west of Holland where it issues from the ground, together with petroleum, will be conveyed to Ijmuiden via a pipe-line about 50 miles long.

It will be used chiefly by the N.V. Maatschappij tot Exploitatie van Kooksovengassen (MEKOG) N.V., in an installation which is to be erected for the production of nitrogenous fertilisers and which will be brought into use by the end of 1960.

This will be the first occasion on which natural gas will be used in Holland as a basic material for the chemical industry.

Stopgap

In addition to its use by MEKOG, it will be possible to employ this natural gas as fuel in the manufacture of steel and iron. It will also be possible to use the natural gas as a stopgap during any breakdown in the public supply of gas by the Hoogovens which provide some 7,000 mill. cu.ft. of town gas a year.

Southern link-up

The Southern Gas Board announces that Beaminster has now been linked into the South Dorset gas grid, the job of laying a new 4-in. cast-iron main to Beaminster having been completed. Gas will come now from the Board's works at Poole, instead of from the local gas works.

Name change

Printar Industries Ltd., is the new name for the Prince Regent Tar Co. Ltd. The change took place on October 21.

GAS COUNCIL RESEARCH SCHOLARSHIPS

Selection from larger number of applicants

'Competition augurs well for the future' says President

SIR HENRY JONES, Deputy Chairman of the Gas Council, said that in presenting the report he would remind them of something which Sir Harold Smith had said the day before, that the scholarships, which were established in 1953, were research scholarships, available in departments of chemistry or chemical engineering at a number of universities set out in Sir Harold's paper.

'When they were first awarded in 1953 it was almost a matter really of finding five scholars to accept the five scholarships. Perhaps it was because they were not very well known. But it was not long before competition for these scholarships became much greater and in recent years the problem of selection has been quite important. I hope we have managed it well, but certainly these scholarships have been chosen from a much larger number of applicants.'

More information

Each year five scholarships were awarded, he went on, but this year there were six reports, because Mr. D. K. Morris, as was stated in the introduction, had not completed his work when last year's report had gone to press. The report gave only a very brief account of the work of each scholar, and anyone who wanted more detailed information on any of the work was invited to write to the Gas Council where the original theses or reports of the scholars were to be seen.

Sir Henry said: 'I should like now to say a few words about the work of the individuals in the order in which they are set out. Mr. D. K. Morris's work was concerned with the absorption of carbon dioxide in sodium carbonate solutions under pressures of up to 350 lb. per sq. in. The aim was to determine the effect of total pressure on the rate of absorption and on the overall mass-transfer coefficient K_G.

Particular interest

'Those who have looked at the programme and noted the title of the last paper to be considered will appreciate that this work is of particular interest to the gas industry, because many processes will be worked at high pressure, and Mr. Morris's investigations will provide useful background information.

'Coming to the work of two scholars, Mr. W. J. Arnold and Mr. R. Salter, which is described briefly in the report, I have to confess that although it is my duty and privilege to present this report, I am not very well qualified personally to explain fully all the intricacies of these two lines of research.

'But Mr. Arnold reviews experimental methods of studying energy transfer and the theoretical aspects of the inter-conversion of vibrational-translational energy, and describes an experimental technique which has been devised for the study of energy transfer in heteromolecular systems involving polyatomic molecules.

Ultrasonic dispersion

'Mr. Arnold held his scholarship under Professor Newitt, and Mr. Salter held his scholarship at Oxford under Professor Sir Cyril Hinshelwood. He worked on the ultrasonic dispersion in gases. The interchange of energy between vibrational and translational degrees of freedom in a gaseous system is an inefficient process and each molecule may have to undergo a considerable number of collisions before equilibrium is established. He describes how energy fluctuates in various ways.

'Both scholars have done work which contributes to our fundamental knowledge of chemical reactions, although one cannot say that they contributed directly to any particular process being investigated. But these scholarships were not intended to be confined to work of direct and immediate importance to the gas industry. It was, however, expected that some would contribute to a general degree of scientific knowledge which sooner or later might prove to be of value to us.

'Mr. P. J. Owens has been working at the University of Birmingham under Professor F. H. Garner on benzene formation in the process for the hydrogenation of oil developed at the Gas Council's Midland Research Station, in which oil is hydrogenated at temperatures between 700° and 800°C. at pressures of 10 to 25 atm. in a vessel containing fluidised coke. Professor Garner is a member of the Gas Council Research Committee and is intimately concerned with the work of the research programme. Mr. Owens' work has been of direct and immediate importance to the processes being developed at Solihull.

'Mr. D. H. Grant studied at the University of Glasgow under Professor Monteath Robertson, and has carried out work on the thermal degradation of polytertiraybutylmethylacrylate. Here again the work of the scholar is concerned with the thermal degradation of certain types of polymer. It is not of direct and immediate interest to the industry, but it is of a nature which adds to the common pool of knowledge, and which may, at some future date be of value to us.

'Mr. A. Wint has been studying at Cambridge under Professor Fox, and has investigated the hydrodynamics of liquid flow in a packed tower. His experiments were carried out using a vertical column of spheres as a model of a packed tower, and he has elucidated the precise nature of the hydrodynamics of liquid flow over the packed tower, both of liquids of high and low viscosity. This work will be of considerable interest in view of the Gas Council's own developments so far as heat and mass transfer are concerned.'

The President thanked Sir Henry and said they were very pleased indeed to learn that there was now competition for the research scholarships, 'I think it is a very good thing, and augurs very well for the success of these scholarships in future.'

Approved items to cost £228,022

PROJECTS totalling £228,022 approved by the Scottish Gas Board, were reported to the area Gas Consultative Council in Edinburgh last week.

Area figures were stated to be: South West, £111,738; Glasgow and West £75,390; Central £37,154; Aberdeen and North £3,750.

Main item in the South West list was the laying of 7.2 miles of 8-in. diameter main and 0.6 miles of 4-in. diameter main, from Greenock to Skelmorlie works, together with governors, at an estimated cost of £58,122.

Another five-figure project from this area was the £25,590 scheme in the Kilmarnock district—laying 550 yds. of 10-in., 2,110 yds. of 14-in., and 250 yds. of 18-in. diameter spun iron mains, together with the necessary connections and the installation of one 4-in. high-pressure governor and one 14-in. low-pressure governor to augment supplies within the district.

Principal projects in the Glasgow total were the fitting of electrical anti-freeze equipment to 24 gasholders in the Division (estimated cost £33,700) and the provision of an air blower system for purifiers at Provan gasworks (£14,900).

In the Central area £37,154 was given as the estimated cost of the provision of mains and services to 1,139 houses in Glenrothes new town.

25th AUTUMN RESEARCH MEETING

Pressure Storage in a Prepared Underground Cavity

By

E. CROWTHER

C.B.E., M.Eng., M.I.C.E., M.Inst.Gas E.

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IN an integrated area of the Northern Gas Board, where a well diversified demand of 35,000 mill. cu.ft. per year is served, it has been established that, provided in each day production equals demand and proceeds at a uniform hourly rate, the swing between maximum and minimum gasholder stock will never exceed 17% of the maximum day's output.

Hence, given accurate prediction of demand, ability always to manufacture exactly at a predetermined hourly rate and willingness to vary that rate each day, a total holder capacity of as little as 25 mill. cu.ft. would theoretically be adequate to serve an area having a maximum day's demand of some 150 mill. cu.ft. These provisos are unduly onerous and are relieved if storage is planned to level out the variations experienced between the days of any one week.

In the area mentioned, provided each week's production equals that week's demand and proceeds at a uniform rate, the swing in gasholder stock will never exceed 45% of the maximum day's output—i.e., about 67 mill. cu.ft.

If less storage than this were available it would have to be decided whether capital would be more profitably spent in providing holder capacity of the 45% level or in installing production plant additional to that capable of a weekly output equal to the demand of the maximum week.

In the area cited, holder capacity was until recently short of the 45% level by about 7 mill. cu.ft. It was shown that an increment of 5 mill. cu.ft. of conventional storage could be fully paid for by operating economies but that second and subsequent increments of the same size would each cost more than it would serve.

The possibility of creating storage capacity by other than conventional means radically changes the situation and the possibilities of storing gas in abandoned coal workings were explored. The hazards associated with such a project could not, however, be faced.

The method used by Imperial Chemical Industries Ltd. for the extraction of salt from a deep seam of rock salt on the north bank of the River Tees, developed to prevent surface subsidence, creates a number of independent cavities in the salt seam, separated from one another by substantial thicknesses of salt. The volume of each cavity is of the order of 1 mill. cu.ft.

Avoiding Subsidence

The possibility of exploiting these cavities as pressure storage vessels for gas demanded investigation and in 1953 a formal enquiry was addressed to the company. In reply it was pointed out that when each cavity had yielded its predetermined quota of salt and was abandoned it was left filled with brine. This brine was relied upon to support about one half of the weight of the over-burden, so that if the Gas Board proposed to remove the brine and put gas in its place that element of support would be diminished or lost whenever the pressure of the gas fell below that of an equivalent head of brine, in fact, below some 45 atm.

It was considered that, to avoid all risks of subsidence at times when withdrawal of gas from a cavity had caused the internal pressure to approach atmospheric, the cavity should be limited to one-third of the customary figure—i.e., to about ⅓ mill. cu.ft. The alternative, to maintain full pressure at all times by displacing gas with brine when withdrawal was required was ruled out by reason of the expense of constructing the necessary ground-level brine tanks and by the inability of the small-bore brine discharge pipe to permit of gas at the rate desired.

Thus, while the costs of drilling down to the rock salt and the provision of water and brine connections would be the same as in the case of a normal cavity, the yield of salt would be only one-third the normal. Hence two-thirds of the normal drilling, etc., costs would be chargeable to the storage project.

Estimates suggested that even with this charge added to the costs of compressors and ancillary plant, of pipe-lines and of building work, the project could be completed within a total sum of £100,000, a very modest figure for the provision of a pressure holder capable of containing, at 30 atm. pressure, as much gas as a 10 mill. cu.ft. low pressure holder.

Boring Begins

The additional storage capacity that this holder would provide would form a part of the total storage of the integrated area previously mentioned and would raise this total to the equivalent of 47% of the maximum day's output of the area. Using this pressure storage as the last element of the total to be brought into commission, the volume of gas to be compressed in a year would not be likely to exceed some 400 mill. cu.ft.—little more than 1% of the total output—while the ability to provide the extra storage at one-sixth the capital cost of low pressure holders of

equal capacity would substantially raise the point at which added capacity would cease to effect a net saving.

It was decided that a case had been made out for the project, although it had become of an entirely different order of size from that originally envisaged—from storage more than 100 times as great, which would have permitted production to be maintained at a uniform rate throughout the year.

(Preliminary boring, which cost £7,789 and is included in the figures given later, proved abortive).

Boring at the present site began in January, 1957, and a month later the salt stratum of a thickness of 115 ft. was encountered at a depth of 1,176 ft. below the surface. The borehole was lined and the well head connected up to water and brine mains in April, 1957. Extraction of the cavity was completed in January, 1959.

Fig. 1 is a diagrammatic representation of the borehole,

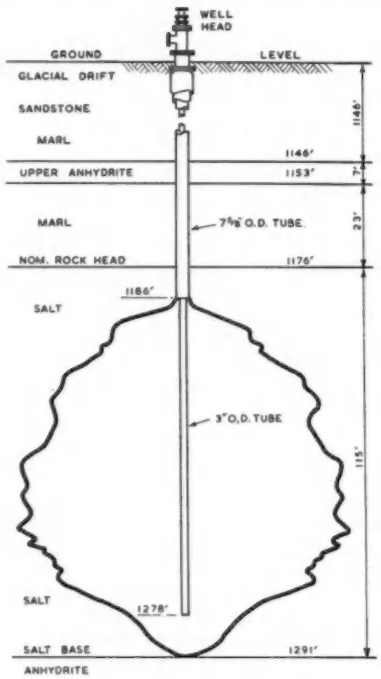

Fig. 1

the strata through which it passes and the storage cavity itself.

The process of extraction consists essentially in introducing a 7⅞-in. outside diameter tube into the upper part of the salt, with a 3-in. o.d. tube threaded through it. Fresh water is pumped through the annular space between the tubes at a rate which permits it to become saturated with salt, and the resulting brine is forced to the surface through the inner tube. To prevent the penetration of surface water through porous overlying strata, the bore is lined with a 16-in. o.d. pipe to a depth of 125 ft. 6 in. from ground level, encasing a further lining tube of 11¾-in. o.d., which extends to a depth of 856 ft. 6 in. Both lining tubes are pressure cement grouted.

Gas was connected up from the compressors to the annulus between the 7⅞-in. and 3-in. pipes, while the inner pipe, extended to within 14 ft. of the bottom of the cavity, was connected at the surface to a brine meter before discharging into the company's collecting system. During this operation 338,000 cu.ft. of brine were expelled and 17 mill. cu.ft. of 'free' gas at S.T.P. had been pumped into the cavity, of which the temperature was 52°F. The pressure of the gas reached 710 lb. per sq. in. gauge as the unsealing point was approached. All valves were closed for a week, during which time no change of pressure whatever occurred. Since, once emptied of brine, it is not intended to exceed storage pressures of 30 atm., the week's test at 160% working pressure was considered to be adequate proof of gas tightness.

Total expenditure on the project amounted to £96,752. Annual charges on this sum amount to £6,961. For comparison, the present-day cost of a conventional 10 mill. cu.ft. gasholder may be taken at £600,000, and interest and amortisation thereon at £31,700 per annum.

Operating Costs

Assuming that 400 mill. cu.ft. of gas will be passed into and out of the cavity during a year, operating costs are expected to be £9,118, making a grand total of £16,079. Combined operating and capital costs, which represent a shade over 2d. per therm of gas injected into the cavity, will thus be about one-half the capital costs alone of a conventional holder of similar capacity.

Estimations suggested that from the first mill cu.ft. increment of storage capacity operating economies approaching £24,000 gross per annum might be envisaged, leaving a net return of perhaps £4,000 per annum after debiting capital and upkeep costs of the holder. From the second increment, possible economies of between £5,000 and £10,000 per annum gross were envisaged. The greater part of the sum of the two gross figures—between £29,000 and £34,000 per annum—has become equally available from the storage capacity of 10 mill. cu.ft. that the underground cavity affords. Deducting the annual costs of capital and operation, a net saving exceeding £10,000 per annum is hoped for from the project.

The present cavity could contain 200 tons of gaseous methane at 30 atm. Alternatively it could contain approximately 5,000 tons of liquid butane or propane.

Having gained a measure of experience it is tempting to speculate on a project of major scale involving say 30 abandoned cavities, which at 45 atm. would enable 1,350 mill. cu.ft. to be stored and production to proceed, except as interrupted by plant repairs, substantially at a uniform rate throughout the year. To avoid ground subsidence, brine tanks of nearly 200 mill. gal. would be required at ground level and withdrawal of gas would be effected by displacement of brine, a pressure of 45 atm. being maintained irrespective of the quantity of gas in store.

While perhaps capital exceeding £1 mill. might be needed, such a scheme would enable production plant of some 40 mill. cu.ft. per day output to be dispensed with —plant the replacement cost of which would be between £4 mill. and £10 mill. depending on its nature.

The project would incorporate itself admirably into a national gas grid scheme.

DISCUSSION

Mr. Crowther, after presenting his paper, added: Since the paper went to print, further series of gas analyses have been made at the well head, using the Gooderham soap film apparatus. Any apparent variations in the composition of the gas after residence in storage or during the various stages of its release have been found to be within the limits of experimental error of the apparatus used.

The slight upward trend in the reading of the recording calorimeter towards the end of the recovery period continues to appear, and has not yet been adequately explained. It is not attributable, as was first supposed, to abstraction by the dry gas of water from the meter of the calorimeter, nor is there any tendency towards a checking of its water flow rate.

One hypothesis, which can only be verified by highly refined methods of gas analysis applied to the released gas

when it reaches the governors, is that re-evaporation of traces of relatively heavy hydrocarbons deposited as condensates in the pipe-line between compressors and well head occurs increasingly towards the end of the gas recovery period, as the pressure in the pipe-line falls to a few atmospheres. Should the Gas Council think well of the suggestion that their research groups might at times use the cavity as a laboratory, the explanation of the phenomenon might be found.

Mr. C. Harold Leach, Chairman, Southern Board, said: Some people find gasholders æsthetically pleasing, their simplicity and pure geometrical form being regarded as having what one might describe as functional dignity. Most of us, however, in this room plus the rest of the British public, find them displeasing in appearance, especially when festooned with painters trying to turn them into a shade of green which nature would abhor.

I am happy to say that I have been able to make some improvement in the Southern landscape by causing some 70-odd holders to be demolished in the last four years, and it hurts me, both æsthetically and financially, when I am persuaded to erect a new one of these inelegant structures. Obviously, one must accept them as a means of steadying gas production against hour-to-hour, day and night and weekend variations and of exploiting the advantage we possess over our main competitor, who is always under the strain of his instantaneous demand.

Gas engineers, generally, seem to have reached some measure of agreement in the way they express the amount of their holder capacity. As a rule, one hears it described as so many hours of a maximum day, in some cases perhaps even irrespective of whether or not gas can usefully be got out of the top lifts.

Debunking Phrase

It is unfortunate that when once some ready means of expressing holder storage such as this is discovered, the more it is used the more it tends to be an actual criterion of how much storage there should be; this, of course, is quite ridiculous, and my staff is well aware of the debunking phrase that I use when anybody asks me how many hours of a maximum day we have got.

I do not think I need to labour this point, but hours of a maximum day is a phoney criterion. If, for example, one was taking coke oven gas seven days a week at a constant hourly rate and you happened to have customers who take all your gas from you at the same rate, you don't need any holders at all.

On the other hand, if you have to take coke oven gas coming at a constant rate over the whole week, but the whole of your load is a five-day one, then you need an enormous amount of holder accommodation. Somewhere between an enormous amount and none at all lies the true figure, and this true figure must entirely depend on local circumstances.

There is no doubt that the war caused a lot of re-thinking to be done on holder accommodation, because it was found in so many cases that one could operate satisfactorily with considerably fewer holders than had hitherto been thought to be necessary. This happy state of affairs was further facilitated by accurate forecasting of deliveries and make; if there is flexibility in the transmission of gas between various sites and the forecasting is sufficiently accurate, then further inroads can be made into the amount of holder accommodation needed; I am assuming that Mr. Crowther, in his inimitable way, has reached what I might call the optimum minimum.

Holders are used to cover make and delivery in four quite separate ways: (1) A three-minute cycle, as in relief holders; (2) a daily cycle—night versus day; (3) a weekly cycle, covering exceptional characteristics of a weekend, such as I have referred to earlier, and (4) an annual cycle. Type (1) is a special case, but I do not need, I know, to mention today that, following the introduction of control gear, holders are becoming smaller as the gasification plants with which they are associated become larger.

Type (2) is a necessity to enable production to be constant in spite of hourly night versus day variations, and the amount of this storage can readily be calculated by examining the hour-by-hour consumption graph on a maximum day and drawing through it the hourly make—the integration of the area between this line and the night consumption is the theoretical storage needed. Type (3) is, as I have said, to allow for the special characteristics of a weekend, and very cleverly, to emphasise this point. Mr. Crowther has regarded type (3) as being separate holders from type (2), although, of course, in actual operation they are the self-same lumps of metal.

This third type is needed to accommodate the increasing stock which would accrue during the weekend if only type (2) were available.

Local Calculation

This type (3) storage might be as low as 25% of the total storage, as in the Southern Gas Board, or as high as 60% in the Northern Gas Board, again reflecting the difference in the incidence of loads versus availability; in other words, it is a matter for local calculation, as I said earlier, within an integrated locality. But clearly this storage is always of great importance if it is absolutely necessary for production to remain at a constant speed.

If the base-load plant at work, together with any purchased coke oven gas is made in relatively inflexible plants at low cost, it is certainly important to have type (3) storage, especially if more flexible plants, making more expensive gas, have otherwise to be used to cover the variations. This question can be fairly simply settled by calculating the relative capital and operating costs of holders against non-base-load plants operating on week days only; if these are equal, then holder storage should be at an absolute minimum.

Usually a variety of differently costing plants—operationwise and capitalwise—is available with their inevitable consequence on the by-product position; thus, as is suggested in the paper, there is a probable field for the use of a digital computer to solve in the optimum way the many indeterminate simultaneous equations, but I know of no such work as having been done in our industry, although similar work has been done in power station and oil refinery control. Generally, in our case, we hope to provide the solution (I wonder how successfully) by taste, rule of thumb or experience.

Mr. Crowther has an extremely attractive application of his weekend storage and, by use of his 'salt cellar'—as I think one might call it—he absorbs the cheap coke oven gas at the weekend which he needs during the other five days. This, he says, costs 2d. per therm to store, and it is obvious in his case that gas made in peak load plant would cost more than 2d. a therm over and above coke oven gas.

Conventional low pressure storage would cost 4d. a therm for type (3) storage and this might not bridge the difference between base load and peak load gas. If c.w.g. is being used as the peak load shaver, it should be taken into account that using virgin naphtha—or, as I think it is called in some parts of the country p.f.d.—instead of gas oil, the gas so made might be as cheap as base load gas and the extra output from c.w.g. made in this might produce in five and a half days what on gas oil would take seven days. Thus the use of this raw material makes it necessary to recalculate the weekend holder storage needed and it may well be that a new holder can be avoided or even an aged one demolished—as we have been able to do in the Southern Board.

Now to turn to Type (4) storage to cover seasonal variations.

Mr. Crowther refers to his interest being aroused in underground storage in 1946 when he came across it in East Ohio. There is quite an element of coincidence here, because I crossed to America in the self-same cabin as Mr. Crowther on that occasion—our ways then parted and at one stage I found myself in California where I was deeply impressed with the arrangements they had already made for underground storage in worked-out oil wells. My interest in this particular subject of underground storage has never left me, because I found it so attractive in its possibilities.

To think in terms of conventional low pressure storage for type (4) is ludicrous. It would cost a fortune. High pressure storage in a 'salt cellar' if it costs 2d. a therm —say 1d. for operation and 1d. for capital—for weekend storage for 50 inflations a year would cost 1d. for operation and 50d. for capital if operated only once a year.

Even if the pressure were increased to 45 from 30 atmospheres, the operation cost might rise to 1½d. and the capital cost fall to 34d. Cost of seasonal storage could be quite unacceptable at this level.

But it is noted [p. 25] that Mr. Crowther, when speculating on seasonal storage, suggests using a group of 30 salt cavities as left abandoned and full of brine after salt extraction. These have three times the volume of the cavity specially made for gas, but have always to be charged with brine or gas at sufficient pressure to prevent subsidence. These abandoned cavities would presumably be available at low cost, but it is estimated that the scheme would cost £1.2 mill., including stored gas, and the total costs for capital and operation would be of the order of 3d. a therm. This would enable gas production plant to be all base-load and plant costing at least £4 mill. could be scrapped when due for replacement.

Anticline Storage

It is interesting to compare this estimate of about 3d. per therm with an estimate for underground anticline storage on a scale almost ten times as great. This estimate works out at 2d. a therm, of which about half is operational cost, a quarter is interest charge on cushion gas and the rest is divided equally between capital costs of the installation and interest charges on the released gas.

Salt cavities, if available abandoned, appear to be able to store gas almost as cheaply as anticline storage. Compared, however, with anticline storage, salt cavity storage. does not involve idle capital in cushion gas and gas can be moved in and out without the quite large delaying affect of the porous medium. Salt cavities can accept gas which has not been elaborately purified, and this is again an advantage, and it is probable too that change of composition is less in salt cavity storage.

Although Mr. Crowther does not say so, I shrewdly suspect that the 'salt cellar' storage was his own personal inspiration which he has transmitted infectiously to his staff. They have earned our immense respect for their persistence. in spite of earlier disappointment, in bringing into operation an effective storage system with so many delightful features.

Mr. A. G. Grant, Northern Gas Board: The paper before us describes more than a successful achievement. It points the way to that Eldorado of the gas engineer—the divorce of gas production from the vagaries of consumption There is little criticism or comment open to the reader. The storage of 10 mill. cu.ft. of gas at 30 atmospheres in the salt cavity at the mouth of the River Tees is a fact, and what is today the largest gasholder in Britain has cost, including compressing plant, a sixth of what a conventional gasholder would, whether high or low pressure; despite the cost of power for compression, the capital charges and running costs together are half those of a telescopic holder.

The author has shown the way, and I sincerely hope that the national search to which he refers for suitable geological strata will be pursued energetically and with all financial support. There may be other salt formations, but on a really large scale the necessary surface storage of brine presents big obstacles. The 200 mill. gal. storage required to support a 1¼ mill. cu.ft. holder and give a constant production rate in the Northern Board would cost £1.5 mill. and would occupy 30 acres of land. On the other hand, the South of England is part of the Paris sedimentary basin, and surely we may hope to find formations such as that near Paris, which is now storing nearly 2,000 times what the Tees salt cavity does.

To the builder of gasholders, whether high or low pressure, the author's results come as something of a bombshell. I believe, however, I speak for the chastened builders of gasholders when I welcome this paper, not only for its intrinsic value, but because it gives a glimpse of a gas industry with renewed competitive strength. Far better for the industry's contractors to lose gasholder orders because of the expansion and prosperity of the industry, than because it is almost in retreat.

Dr. James Burns, G.M., Member of Council and past-president of the Institution, said: We have a very special interest indeed in reaching the stage when we shall no longer be dependent upon variations in consumption from one day to another and from one season to another. At the present time we have to cater, whether we like it or not, for precisely four times the output in one day in the winter that we have on the lowest day in the summer. Taking the average week in the winter, it is 3½ times the average week in the summer, and that costs an awful lot of money. It is only in the past few years that we have learnt to combat these costs to a very large extent by the introduction of new methods, such as the storage of gas in a concentrated form. However, whether we like it or not, seasonal and peak load gas is undoubtedly more expensive than base load gas. If it were not, we should use the methods for seasonal load production at all times of the year.

It is possible to calculate what would be the effect of making gas at the same load level throughout the year, which we could do if we had complete seasonal storage. My calculation can only be rough. The reduction in costs for my Board would be about 20%. That, of course, cannot possibly take into account the very large amount in the way of hidden benefits which you would get from continuous maintenance of plant and, above all, a more stable labour force which would work happily and contentedly throughout the year, without fear of being redundant in the summer and overworked in the winter.

I think, too, that we should look a little further forward at the new problems which may confront us in the types of gas to come. I will deal particularly with liquid methane, for with liquid methane we have a greater case than ever for the necessity for seasonal storage, because liquid methane is dependent upon transportation by very expensive ships, which have to operate throughout the 365 days per annum as nearly as maybe.

It is true that we can store our liquid methane in a very highly concentrated form, and the costs of storage are not nearly so high as the costs of storage of low c.v. gas at the present time, but with liquid methane we would welcome very sincerely the opportunity of storing our gas underground in seasonal storage form.

The question is bound to arise whether it is wise or unwise or what is the right thing to do, to store our gas in a concentrated form or in a form ready for sale to the public. There are obviously pros and cons in either direction. If we store it in concentrated form at 1,000 lb. per

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sq. in. and sell it at 500 lb. per sq. in. we double our storage requirements. At the same time, if we do that we have to provide a plant to meet the peak, and that is a big disadvantage.

It is interesting that in Hamburg, where they have successfully located underground storage quite close to the city, they store in a concentrated form at 1,000 and 1,500 B.t.u. That is obviously a question of calculation of the economics for and against storage at high concentration. They will probably find if their storage is low in capacity that it will pay to store at high c.v.

We are fortunate in the gas industry in already having storage which looks after the peak hour. In that respect, we are very much better off than our friends in the electricity industry. Already they are looking over our shoulders to find out how they can store and get rid of the hourly peak. But the hourly peak is nothing compared with the seasonal peak, and although we are relatively well off with the hourly peak, we have a very expensive load to supply on the seasonal peak.

Manufacturing Point

It is interesting to look forward to a potential customer of the gas industry in the future. I think that neither the gas industry nor the electricity industry will be allowed to put up very high and very big production stations in built-up areas. I believe that the days of the Battersea power station and the Battersea gasholder are at an end. It may be that in all cases production will be required to be away from built-up areas except insofar as that production can be carried out in a completely clean way. As far as the gas industry is concerned, I do not think that will in due course present any great difficulties, because gas will in any case be manufactured far away from the point where it is used.

In the case of the electricity industry, it is more difficult because the transportation or transmission costs of electricity are very much higher than the transmission costs of gas, and the cost of transmitting peak load electricity will be practically impossible.

It appears that the electricity industry, too, is highly interested in our underground storage of gas, though it looks upon this as a potential source of raw material which is available to it at all times and which can be transported cheaply to the point of usage of electricity and there converted into electricity on a completely clean and pollution-free basis.

Mr. D. E. West, Engineer and General Manager, Merthyr Tydfil and Dowlais undertaking, said: It appears that another extremely important problem can to a great extent be solved by the introduction and development of this form of storage.

That is, large volumes of gas of the correct type as normally used in a particular area of supply, can be 'banked' for transmission and use during peak or emergency purposes, thus avoiding, for example, the fluctuations in specific gravity sometimes experienced when meeting such demands by introduction of what may be termed unsuitable 'topping-up' gases.

Mr. Crowther refers to the fact that American geologists have in their search for additional underground storage facilities considered the use of non-petroleum bearing anticlines. It is also significant that the rapidly increasing winter demands in the U.S.A., which could well be the shape of things to come in this country, have caused the U.S. gas companies to list additional underground storage facilities as of the most urgent of their proposed capital development projects. In fact, the East Ohio Gas Company is at present engaged on a process whereby they have hydraulically fractured 41 of their storage wells. This consists of forcing kerosene and sand at very high pressures into the former gas-bearing rock formation, splitting the rock and providing more storage spaces for the natural gas in the existing spent wells.

I sincerely trust that it will be possible greatly to extend a system of off-peak gas storage facilities generally as indicated in the paper with financial as well as technical improvements so vital—I think you will all agree—if the industry is to make further steady progress.

Mr. J. Foxton, South Western Gas Board: There are two points that I see about this question of underground storage. I believe that one factor has already been borne out quite noticeably in America. There they can put clean natural gas into the underground wells, but they are then faced with the problem of having to purify the gas on taking it out because of H_2S. We know that we get this H_2S evolved from gasholders and that it costs quite a lot of money to treat it. I feel that this same problem has been encountered in America.

What methods of control can we use? Does it mean that the Ministry would have to relax its standards of H_2S content, or does it mean that if underground storage is adopted to any extent we shall then have to install some method of purifying the gas which has been stored?

My second point is concerned with the emphasis which has been put on gas produced from oils and low p.f.d. Are the gases going to be suitable for storing at high pressure? We know that 30-50 B.t.u. of hydrocarbon is yielded in the gas, and often more, when using p.f.d. You just cannot compress that gas and put it into a holder and reduce your pressure to atmospheric pressure and get those B.t.u. back again. Therefore, they are lost. That can mean that if you store a high c.v. gas in which the B.t.u. are held in the form of hydrocarbons, then they are lost and would have to be made up on restoring the gas to the district.

It seems to me that problems can arise from this underground storage and that we should have to use new techniques in restoring the gas to the proper standards.

Mr. K. Francombe, Whessoe Ltd., Darlington: As the largest single item of annual expenditure in Mr. Crowther's scheme is for the compression into the holder, I wonder whether this and the many other examples of the wasteful let-down of high pressure gas in the country do not provide a challenge to the makers of expansion turbines to re-study this problem of recovery of energy from high pressure gas.

Although Mr. Crowther is in the fortunate position of using off-peak load electricity for compression, even though perhaps only half of the compression costs could be recovered in an expansion turbine, this would greatly contribute to the reduction of the annual costs even with this already cheap form of high pressure storage. I realise that especially with variable high pressure storage, such as Mr. Crowther is practising at the moment, as distinct from the variable volume high pressure storage which he contemplates in the future, the problems are very difficult in that the expansion turbine would have to deal with a range of inlet pressures, and, of course, there is the other difficulty of providing the necessary heat to counteract the expansion cooling effect. However, these problems have been solved when vast numbers of such installations are required, as in the aircraft industry. I agree that the number of similar or identical units which would be required in the gas industry might be much less and, therefore, would not provide quite the same sales incentive to the turbine makers, but I would put forward the thought that it would vastly contribute to such schemes if this energy could be recovered other than by the conventional pressure reduction governors.

Mr. E. Crowther, replying to the discussion: I should prefer to have an opportunity of thinking over the many profound things which have been said in the course of the discussion before I attempt to make any considered reply to them.

Gas prominently featured at architects' and builders' big event

Building exhibition clarifies whole-house heating concept

THE 28th Building Exhibition at Olympia which runs until December 2, was opened last week by Lord John Hope, Minister of Works. It emphasises the growing importance of the building industry in this country. Held every two years since 1895 except for the war years, it now occupies the entire space in all three halls, including the second floor gallery of the Empire Hall, which is given over to the painting and decorating side of the industry. On this floor, too, the apprentice competitions are held, which have attracted some 600 apprentices in a variety of trades from all over the country.

The exhibition is conveniently divided into three main sections, all of which are easily identified in the well got up catalogue by the use of different coloured paper. Exhibitors of building materials are to be found on the ground floors of the Grand Hall and part of the National Hall, and on the first floor galleries. Contractors' plant and machinery are in the remaining part of the National Hall and in the Empire Hall where there is also a woodworking section.

Such exhibitions are particularly valuable to the gas industry since builders and architects are better able to see at a glance how important it is for them to incorporate the latest whole house heating appliances at the design stage. The use of new building materials will help our industry to find easier ways of installing modern space-heating appliances in houses planned or under construction and facilitate the installation of up-to-date gas-fired central heating and domestic hot water systems in existing property with the minimum of disturbance.

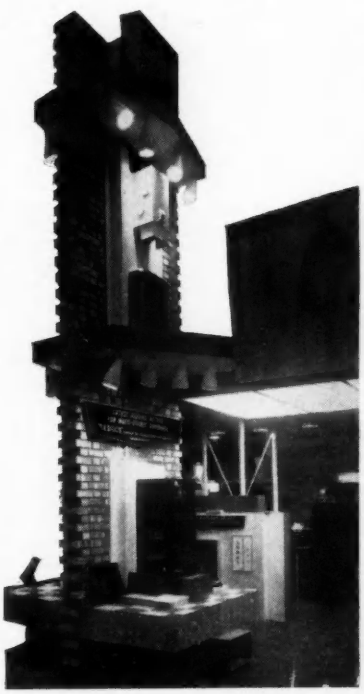
The theme of the **Gas Council's** stand is exactly this and its main features are space heating, central heating and modern flueing systems. Branch flues, 'X' blocks and Se-Duct flueing are on show, the two latter being built to a height of 20 ft. to represent three floors of a multi-storey block of flats. A working gas-fired boiler, attached to a small more central heating system, a gas-fired Caloric incinerator, specially useful in large blocks of flats, and Halcyon and Ductair warmed air equipment are also on view.

The Coal Utilisation Council are displaying a wide range of attractive modern solid fuel appliances available to meet every domestic heating requirement—full and partial central heating, individual room heating, hot water and cooking.

At the stand of the **Department of Scientific and Industrial Research** are being displayed items of recent work including dry internal finishing and perforated clay bricks. Technical films are being shown at a small cinema and building problems can be discussed at an information centre.

A.C.E. Machinery Ltd. are displaying a new type of passenger hoist, a face walling cladding crane, concrete vibrators with motorized heads, mobile hoists, scaffold cranes and concrete elevating plants.

Ascot Gas Water Heaters Ltd. are showing types 509 boiling water heater with three-point temperature control and the 715 balanced flue heater. The single point and/or multipoint sink heater type 512 appear for the first time. A 727 heater is fitted to a section of Se-Duct and illustrates its method of installation.



A section of the Gas Council's stand at this year's Building Exhibition showing the Se-Duct fluing system built to represent three floors of a multi-storey flat with gas-fired appliances on each floor.

F. A. Borchardt Ltd., are showing the full range of DRUgasar balanced-flue space heaters including the new models; JBN, equipped with magneto ignition and flame protection control; the small 650, with a rating of 20 cu. ft. per hour and fitted with closed guard, and the GN with glowplate ignition. The Arnhem free standing stove suitable for No. 3 coke is also shown.

The Elastomers division of **British Paints Ltd.,** are exhibiting examples of their synthetic rubber sealants and coatings for the building and civil engineering industries

Cannon (GA) Ltd., are showing the Cannon cooker—plus the Super-Chef built-in foldaway barbecue-grill, which brings back to the kitchen all the advantages of open spit-roasting. Seen also on this stand is the multi-purpose Power-Maid to provide from a single unit, power for a number of kitchen uses, and the GasMiser convector fire fitted with the Gasminder thermostat finished in a number of colour schemes.

Crane Ltd., are exhibiting a selection of their boiler range which includes the Crane 20, for storage tanks up to 35 gall., small heating boilers—the popular Cavendish range, the Carlton series 10A for the larger house and for larger installations the Whitehall series.

Appliances shown for heating individual rooms include the Pall Mall hospital, wall and concealed radiators, and the modern Crane skirting heating.

Crosby & Co. Ltd., suppliers of purifier grids to the gas industry are exhibiting a number of doors of various types including their standard flush door, and an external panel door faced in teak.

Samuel, Denison & Son Ltd., show their Model T.I.E. portable compression testing machine of 150 tons capacity by ¼-ton increments. It has a 3-speed built-in load pacer for 4-in., and 6-in. concrete cubes, and 12-in. by 6-in. diameter concrete cylinders. Their Model TIB/MC compression and transverse testing machine of 200 cu. tons capacity in compression, and 10 cu. tons capacity in transverse with a removable load pacing unit as an optional extra is also on view.

Electrolux Ltd., are featuring their M27 built in refrigerator designed to be

installed at any convenient height—at waist level or floor level—which saves valuable floor space. The vitreous enamel interior has a capacity of 2¼ cu. ft. and a shelf area of 5½ sq. ft.

Evode Ltd., are showing the products of their four divisions, industrial adhesives, mastics, buiding chemicals, and paints either as an integral part of the stand itself, or where that is not possible, in separate displays. Acoustic tiles, bonded with Evo-Stik 528 'impact' adhesive to a ceiling are shown while the same standard adhesive is used to bond Laconite plastic covered wallboard to the walls of an upstirs room. I.C.I.'s P.V.C. fabric Mural Vinyde and C.P.A.'s Rydura, bonded with Evo-Tex SL820 are also shown.

Hattersley Brothers Ltd., are displaying Vulcan gas-fired central heating boilers Nos. 1, 2 and 3—the two latter are new products—with outputs of 33,000 to 66,000 B.t.u. Specially designed for domestic use, they are thermostatically controlled and completely encased in enamelled sheet steel. The Swinton sunken fire is also being shown.

Hilmor Ltd., are exhibiting for the first time, among a large and comprehensive range of hand and hydraulic operated, and motorised tube bending machinery their model TPH.5 portable hydraulic bender for ½-in. to 2-in. nominal bore tube. Rotary hydraulic machines, ratchet operated three point benders and R.P.5. machines are demonstrated daily by skilled operators.

Ideal Boilders & Radiators Ltd., are showing a new range of gas-fired boilers for domestic central heating and among cast iron radiators, the Neoline, which, designed for any length and in however many sections it may be installed, appears as a single panel.

Kay & Co. (Engineers) Ltd. are exhibiting a number of their well-known Kontite gun metal fittings for hot and cold water services. Included also are gun metal polythene fittings and screwed liner fittings for industrial heating systems.

The Lead Development Association's display demonstrates primarily the use of lead sheet and pipe in building, though in addition, there are a number of references to other building materials in the use or composition of which lead plays a part.

The Association's 16-mm. colour films —'Lead for Building' and 'Lead the Enduring Metal'—are shown at frequent intervals.

As one of the largest manufacturers of bricks, the **National Coal Board** show types from each of its divisions. Synthaprufe, the liquid water proofing and joining material made from tar and latex, Presomet, a bituminous black paint, and Presotim, a wood preservative in colours, are also displayed.

Newton, Chambers & Co. Ltd. are showing their Redfyre range of space heating appliances, which includes the new Convector No. 2, the Redfyre 60 continuous burning fire, the Hearth Redfyre with under floor draught, and the Redfyre Magazine boiler with an output of 20,000 B.t.u. per hour.

Thomas Potterton Ltd. are showing a range of gas fired boilers of the Diplomat range. The Potterton warm air unit is shown connected to a Diplomat 30 gas-fired boiler and installed in the roof of the stand, demonstrates how this appliance conveys warm air through the ceiling of the room. A Diplomat 66 boiler is shown equipped for small bore central heating.

Radiation Group Sales Ltd. show on their Gas Division stand No. R230, the New World Stratalyn gas water heater, New World circulators, and the New World Seventy-Two built-in gas cooker designed to be installed as two separate units, as well as their range of convectors and Radovector gas fires.

On stand No. M203/4 in conjunction with **Bratt Colbran Ltd.,** a member company, **Radiation Ltd.,** are showing two new low cost central heating units in operation. Displayed for the first time is the Parkray 6 back boiler, which is shown with other members of the series on this stand.

The Rawlplug Co. Ltd. are showing their range of Rawlplugs from size 3 for light jobs to size 30 for a direct load of four tons, and Rawlbolts in two types from $\frac{3}{16}$ in. to 1 in. diameter. Rawltools, durium masonry drills, Vibroto drilling machines, are also being shown. Other fastening devices include Rawlanchors and Rawl toggles for blind fixing, and Rawlties and Rawloops for concrete constructional work.

Sperryn & Co. Ltd. are showing their range of thermostatic gas controls for domestic and industrial installations in addition to all types of water fittings, valves, and other non-ferrous fittings.

The Stanton Ironworks Co. Ltd. are exhibiting part of their wide range of spun-iron pipes, flexible joints and special castings for gas, water and sewage mains. Included too are a selection of their spun concrete pipes and flexible joints.

Stewarts & Lloyds Ltd.—On this stand are to be seen a wide range of their products; black and galvanised steel tubes, steel tubes with security coatings, glass tissue wrapping and bitumen lining. Fittings shown include Viking-Johnson couplings and Victaulic joints.

James Stott & Co. (Engineers) Ltd. are devoting their stand to demonstrating their kitchen planning service which is freely available to architects, consulting engineers and builders. An entirely new edition of their publication 'Planning for Catering' has been prepared for this exhibition. On the stand is also shown typical examples of the detailed service plans Stotts supply.

Walker, Crosweller & Co. Ltd. are exhibiting a selection of their range of Leonard thermostatic mixing valves, including the industrial T.S. types and the Leonard steam water heaters. The Mezatap, which delivers exactly a pint of water in 45 seconds for ablutions, is shown for the first time. The Unatap spray mixing taps, which save water and fuel as well as being more hygienic, were also on view.

Yorkshire Imperial Metals Ltd.—On this stand, now in the Grand Hall, the main display shows copper tubes and fittings for small bore forced circulation central heating systems. Other items displayed are Kuterlon/Yorcalon copper tubes for underground water pipe-lines and radiant panel installations, Kuterlex polythene and p.v.c. covered copper tubes for gas and water services, Yorkshire capillary fittings in copper and Yorcalloy seamless fittings.

PERTH SURVEY—HOUSEWIVES PREFER GAS

BEHIND the decision of Perth town council to allow tenants at Letham freedom of choice between electricity and gas, is the story of an independent survey carried out on behalf of the Scottish Gas Board by Research Services Ltd., London.

The council ratified a recommendation of the housing committee—which reversed a previous decision—taken after a survey of its own, to provide only electrical services to the new houses.

Carried out in September among 200 Perth housewives, the new survey was concerned with their preferences for cooking, water heating and space-heating. It found that the absence of gas supplies would affect the greater part of the population, mainly because a majority (66%) would want to use gas for cooking.

For water heating, there was a sizeable minority (about 20%) intending to use gas appliances. There was also a minority, a larger one, for using electrical methods.

The proportion of people wishing to use gas for space-heating was about 10% against over 50% who would use electricity.

In a summary of the findings of the survey, the Board pointed out that the majority of tenants stated that they used gas for cooking at present and would continue to use the same fuel. A large proportion would continue to use gas if they had to purchase their own equipment. The survey drew particular attention to the fact that preference for gas was more frequent among working-class housewives.

Concerning water heating, only a quarter of those interviewed used gas water heaters and even less used electrical equipment. Among the working-class community, the wish to use immersion heaters was less frequent and many expressed their intention to instal new instantaneous gas heaters when the opportunity presented itself.